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METEOROLOGICAL REVIEW

NOVEMBER 1943

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NORTH ATLANTIC HURRICANES AND TROPICAL DISTURBANCES OF 1943

By HOWARD C. SUMNER

[Weather Bureau, Washington, December 1943]

THE hurricane season of 1943, statistically near the average of the past several years, contributed two interesting and significant approaches for investigation. They came in connection with two of the most severe tropical storms of the year, the hurricane of July 25-28 that passed inland over the Houston-Galveston Bay area of Texas, and the intense hurricane of August 20-26 that passed northeast of the Lesser Antilles.

One was the unusual three-pronged pressure fall traced by the barograph pen at the Galveston city office during the passage of the July storm. A copy of the trace sheet is reproduced as figure 1. Many modified examples of these secondary pressure falls have been noticed in connection with the passage of other hurricanes, notably the New England hurricane of 1938, but nothing as clear cut and symmetrical as this trace has been available for study.

The other feature, and one offering greater possibilities for research, involved flights through the two hurricanes by officers of the Army Air Corps. Flights through the earlier storm were made from the Instructor's School at Bryan Field, Tex. On the first flight Col. Joseph P. Duckworth was accompanied by Second Lt. Ralph M. O'Hair, navigator, and on the second trip by First Lt. William H. Jones-Burdick, a pilot weather officer. This is the first time, to our knowledge, that a plane has been intentionally flown through the center of a hurricane. The flights were made at altitudes between 4,000 and 9,000 feet. The following bird's-eye view description of the "eye" of a hurricane is quoted from Colonel Duckworth's report:

As we broke into the "eye" of the storm we were, of course, contact, and could see the sun and the ground. Apparently the "eye" was like a leaning cone as observation of the ground showed a considerable ground wind.

At another point in his report, describing flight conditions, he said:

On the whole, neither flight through the hurricane was as uncomfortable as a good, rough thunderstorm. Rain had been encountered in thunderstorms which was heavier than the rain in the hurricane, to say nothing of much more severe drafts and choppy and bumpy air.

Later in the season observations were reported by Capt. Gordon H. MacDougall, Army Air Corps, during two flights through the hurricane of August 20-26. These flights were made from the island of Antigua, British West Indies, during the morning hours of the 20th and 21st of August. Various meteorological elements were observed and excellent cloud and swell observations were obtained.

Sea conditions observed within the storm area are described in this excerpt from his report:

For those of us who had spent enough time in the Caribbean to be familiar with the magnitude of the waves usually encountered, it was hard to believe what we saw below. The seas were tremen-

dous and the crests were being blown off in long swirls by a wind that must easily have exceeded 70 miles per hour. The long parallel streaks of foam streaming from one wave to another made it evident from which direction the wind was blowing.

Captain MacDougall reported that after pictures were taken an examination of the camera lens showed a salt residue from water droplets deposited at 1,000 feet.

To determine whether the natives possess any understanding of the precursory signs of an approaching hurricane, several natives were queried, with this result:

Our actual findings were that the natives were in all cases completely unaware of imminent danger. Twelve hours before the hurricane was to approach critically near the island we broached the subject with four of the more erudite looking natives of remote Willikies Village. Three of them said honestly, "I cawn't exactly say, mawn." The last one countered with, "No, it's the bloody rain that makes the wind this way."

Below are descriptions of the individual storms taken in the main from station reports.

Hurricane of July 25-28.—The hurricane that passed inland over the Bolivar Peninsula, on the upper Texas coast during the early afternoon of July 27, was the most severe storm experienced in the Galveston Bay area since the hurricane of August 16-18, 1915. It was a storm of rather small area but unfortunately passed over the most densely populated and highly developed portion of the Texas coast.

A partial circulation aloft had been noticed over the extreme southeastern portion of the United States and the eastern Gulf of Mexico as early as July 23, but no disturbed surface conditions were observed until the early afternoon of July 25, when wind shifts from southeast to northeast at Burrwood, New Orleans, and Biloxi indicated a disturbance south of Burrwood. Within a few hours heavy seas were reported on Mississippi Sound. The highest wind reported while the storm was moving westward south of the Delta was Beaufort force 7 (32-38 miles per hour), recorded at Burrwood.

During the next 2 days the disturbance increased rapidly in intensity and moving west-northwestward to the Texas coast passed inland over the Galveston Bay region, between noon and 1:00 p. m. (C. S. T.) July 27, as a small intense storm accompanied by full hurricane winds.

Galveston Airport recorded a maximum wind velocity of 74 m. p. h. and Houston Airport 85 m. p. h. while a gust of 104 m. p. h. was recorded on a slack diaphragm anemograph at Texas City. Other maximum wind velocities were: Port Arthur, 54 m. p. h.; Galveston city office, 63 m. p. h., extreme 68 m. p. h.; Ellington Field, 54 m. p. h., and Houston city office, 59 m. p. h.

The calm center of the storm was felt over almost the entire length of the Bolivar Peninsula and reports say its passage required about an hour. Since, at this point, the storm was moving 12 to 14 miles per hour

the calm center or "eye" was about 12 to 14 miles across as it passed inland.

The lowest pressure reported during the passage of this storm was 980 millibars (28.95 inches) recorded at both the Galveston city office and the Houston Airport. Unusually heavy rainfall accompanied the storm. Both Port Arthur and La Porte recorded a fall of over 17 inches during and immediately following its passage.

Damage in connection with this hurricane has been estimated at \$10,000,000 in the Galveston area, \$6,250,000 in the Houston area, and \$300,000 in the Port Arthur area, a total of \$16,550,000. A large amount of the damage was caused by wind-driven rain. Tides were not unusually high and they caused comparatively little damage, although lowlands along Bolivar Peninsula were flooded and several hundred head of cattle were reported lost in this area.

Nineteen persons lost their lives in the storm. The U. S. Engineer's dredge *Galveston*, dragging two anchors, struck the north jetty off the entrance to Galveston Bay and went down in 40 feet of water with the loss of 11 members of the crew. The tug *Titan* foundered at sea en route from Corpus Christi to Port Neches with the loss of 3 lives. Two deaths were reported in Houston, and 1 each in the 3 cities of Galveston, La Porte, and Port Arthur.

Another severe loss, one not easily calculated, comes from work stoppages and slow-downs in all types of industry. These are due not only to flooding, wind damage, and the resultant light and power tie-ups, but also stem from the storm threat itself which keeps many workers away from their places of employment. In the congested area affected by this storm many plants lost 2 full days' production.

Tropical disturbance of August 13-19.—A disturbance of moderate intensity was first detected on August 13, near 17° N. and 60° W. Moving northwestward until the evening of the 17th, it then turned north and northeastward, passing about 200 miles east of Cape Hatteras. From this point it decreased rapidly in intensity and lost its identity near 41° N. and 61° W. It did not develop winds of hurricane force.

Hurricane, August 20-26.—This large and intense hurricane was first observed on August 20 in the area east of the Lesser Antilles. Moving in a parabolic course, it passed some distance west of Bermuda, joined with a storm that had moved off Labrador at about 51° N. and 42° W., intensified, and moved rapidly northeastward across the Atlantic and north of Scotland. Winds of Beaufort force 12 (over 75 m. p. h.) reported at Bermuda, August 24, while the storm center was estimated to be 100-150 miles west of that island, indicate the large area of hurricane winds that accompanied the storm. At 12 noon, August 24, Bermuda reported a barometer reading of 1,002 millibars (29.59 inches).

Hurricane of September 1-9.—No previous charted history is available for the fully developed hurricane that appeared southeast of Bermuda on September 2. On the 3d it passed about 125-150 miles east of Bermuda and then began to curve slowly northeastward. At this point its progress was retarded for several days by a strong high pressure area, after which its course was changed to northwestward, then north, and later to northeastward as it moved into Newfoundland on September 9.

Disturbance of September 14-16.—A disturbance developing in the northern end of a trough of low pressure at about latitude 30° N., longitude 72° W. was accompanied by gale winds as it moved northward and northeastward. It passed about 150 miles east of Cape Hatteras on the 14th,

skirted Nova Scotia, and reached Newfoundland on August 16.

Hurricane of September 15-19.—From September 12th through the 14th winds aloft showed a partial circulation off the Gulf Coast of Mexico, and by the 15th this circulation was evident in surface observations. During the night of September 16th a high-pressure area, centered over the northern Plains States, blocked the north-northwestward progress of the storm and forced it into a loop which was completed during the 17th. Evidence suggests that this storm was of a violent nature and extended over a wide area during September 16-17. At this period of its existence the disturbance was at its height and while still approximately 80 miles from the coast caused a wind of 62 m. p. h. and a tide of 4.5 feet at Freeport, Tex. Galveston about 120 miles distant from the center reported a wind of 38 m. p. h. (extreme 40), and Port Arthur about 180 miles removed experienced winds ranging as high as 47 m. p. h. (extreme 54).

At Galveston sea swells decreased from a rate of 8 per minute, during the late afternoon of the 15th, to 6 per minute at 6:00 p. m. (C. S. T.) on the 16th.

The level of the water in Lake Ponchartrain exceeded all previous records, rising 0.2 foot higher than the previous record, observed during the passage of the severe New Orleans hurricane of 1915.

The lowest barometer reading along the coast was 1010.5 millibars (29.84 inches) observed on September 16, at Freeport, Tex.

The storm decreased rapidly in intensity during September 18-19, and no winds in line with those that caused damage 2 days earlier were reported as the storm moved inland over the southwestern Louisiana coast.

Heavy rains that accompanied the storm were responsible for most of the damage. At Raceland Prairie, about 2 miles south of Raceland, a combination of heavy rain and backwater inundated an area of approximately 6 square miles to a depth of 3 to 5 feet, and water in Bayou False rose to within several inches of the top of the retaining levee. Although flood conditions required that numerous families be evacuated to higher ground no loss of life has been reported. In Jefferson County damage to property has been estimated at \$15,000 and to crops \$175,000. About 5 percent of the rice crop in this county was lost as a result of the storm. In the Galveston-Freeport area damage, mostly to buildings, amounted to about \$5,000.

Disturbance, September 28-October 1.—Forming as a weak wave southwest of Bermuda on the 28th, this storm developed gale winds as it moved northwestward and passed inland over the coasts of Maryland and Virginia during the afternoon and evening of September 30. In the early afternoon, Cape Henry, Va., reported a maximum wind velocity of 56 m. p. h. (extreme 66) from a northwesterly direction. The lowest pressure recorded at that station, 1003.1 millibars (29.62 inches) was registered about 8 p. m. Wind gusts of approximately 60 m. p. h. were experienced during the afternoon at Norfolk Airport.

In the Norfolk and Cape Charles areas gales and heavy downpours of rain caused considerable damage to crops, and high tides with the rain caused flooding of some streets in the downtown portion of Norfolk. One small ship and several small boats were sunk. Property damage was estimated at \$5,000 and crop damage at about \$15,000.

Disturbance, October 1-3.—This disturbance was first noticed some distance southeast of Bermuda, and after passing slightly west of that island on October 1-2, curved to the northeastward and lost its identity in the North Atlantic near 45° N. and 55° W. At 7:30 p. m.

(E. S. T.), on October 1, Bermuda reported a wind of force 7 (32-38 m. p. h.).

Hurricane of October 11-17.—A moderate disturbance that moved westward through the Windward Islands near Santa Lucia on the 11th, turned northward near longitude 68° W., passed through Mona Passage, accompanied by hurricane winds, and continued on an almost straight northerly course to the Atlantic coast, where it passed inland near the Maine-New Brunswick border with greatly decreased intensity. No gale winds were reported along the Maine coast. Bermuda reported a wind of force 8 (39-46 m. p. h.) as the storm passed about 150 miles west of that island on October 16.

Disturbance, October 21-22.—During October 21 and 22 a tropical disturbance, of moderate gale force, moved through the western Caribbean south of Swan Island into the Gulf of Honduras, and dissipated near the east coast of Guatemala.

Three additional tropical disturbances developed during October, one in the Gulf of Mexico on the 1st-2d, and two in the western Caribbean region on the 25th. They were apparently of slight intensity and are not included in the table or chart of tracks.

A tabular listing of the North Atlantic hurricanes and tropical disturbances of 1943 is given at the end of the summary. Their tracks, numbered I through X chronologically, are shown in figure 2.

*Severe hurricane that passed inland, October 9, on the west coast of Mexico, near Mazatlan, Sinaloa.*¹—Meteorological data contained in the following summary were secured by Arnold P. Eliot of the U. S. Weather Bureau from records supplied by Prof. Vasquez Schiaffino, Chief of the Meteorological Observatory at Mazatlan.

At 9:30 a.m. (90 meridian time) on October 9, 1943, a tropical storm of considerable intensity struck the west coast of Mexico, passing inland a few kilometers south of the Port of Mazatlan, Sinaloa.

The disturbance apparently formed in the area between the Revilla Gigedo Islands and the Marias Islands during the evening of October 8, and moved rapidly northeastward to the coast where it destroyed the small towns of El Roble and Palmillas and partially destroyed Villa Union and the Port of Mazatlan. After passing inland it apparently dissipated upon reaching the mountain range near the coast.

Barometric pressure at the Mazatlan Observatory began to fall at 1:30 a. m. on October 9, reaching a minimum of 958.6 millibars (28.31 inches) about 8 hours later. An extremely rapid fall of 0.827 inch took place in 8 hours.

A maximum wind velocity of 134 m. p. h. was reached about 9:30 a. m. This velocity was recorded for a period of 15 minutes ending when the anemometer was blown loose. Precipitation was light during the actual storm passage but approximately 2 inches fell during the rest of the day.

In the towns previously mentioned about 100 persons lost their lives. Property damage amounted to about \$4,500,000. Several fishing boats and a small Mexican naval vessel were caught in the path of the hurricane, and as no trace has been found, they are presumed lost with all hands. A small coastwise boat arrived in port with 6 of her crew missing.

¹ Included in Summary of North Atlantic Tropical Disturbances as a matter of record.

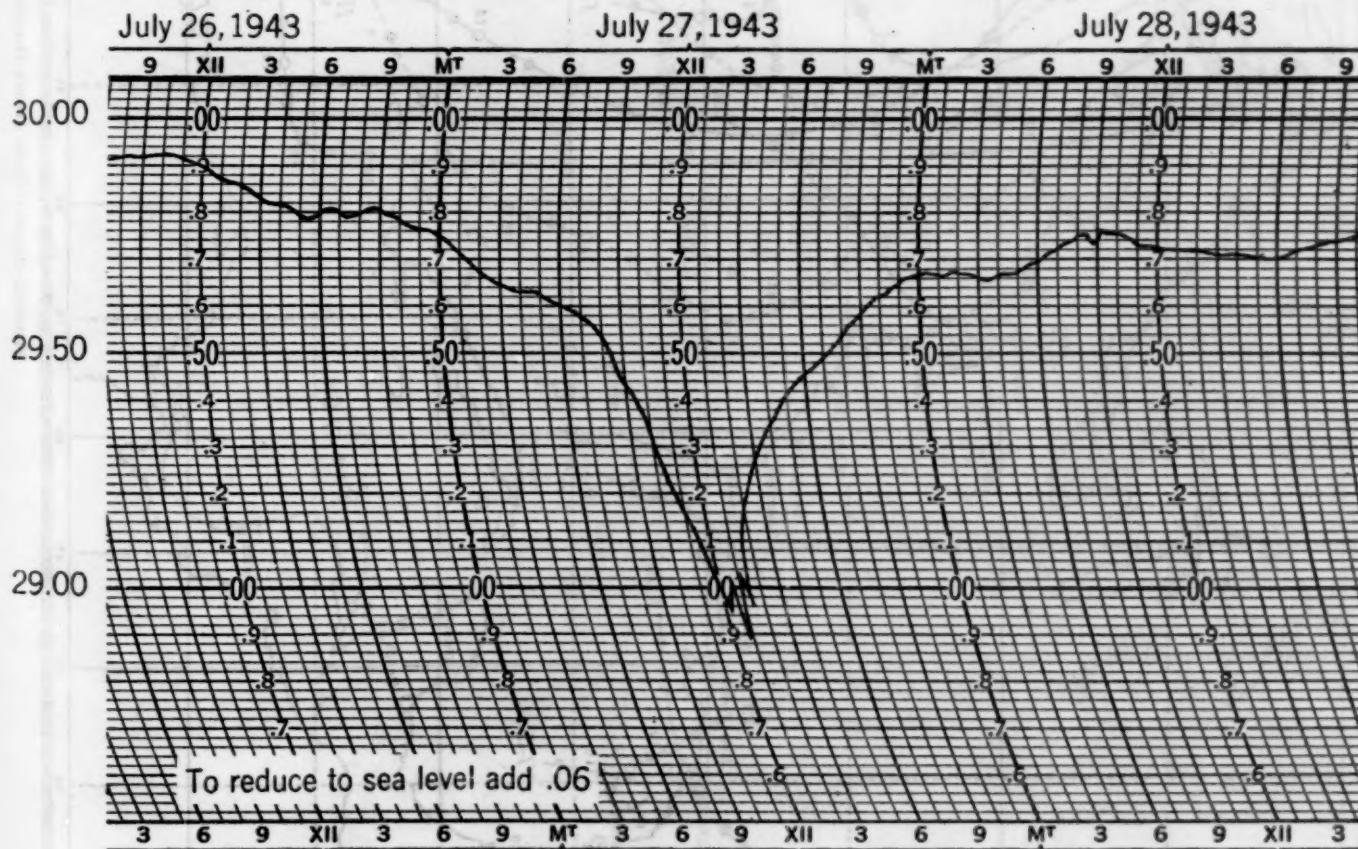


FIGURE 1.—Reproduction of the Galveston City Office barogram of July 26-28, 1943. (90th mer. time.)

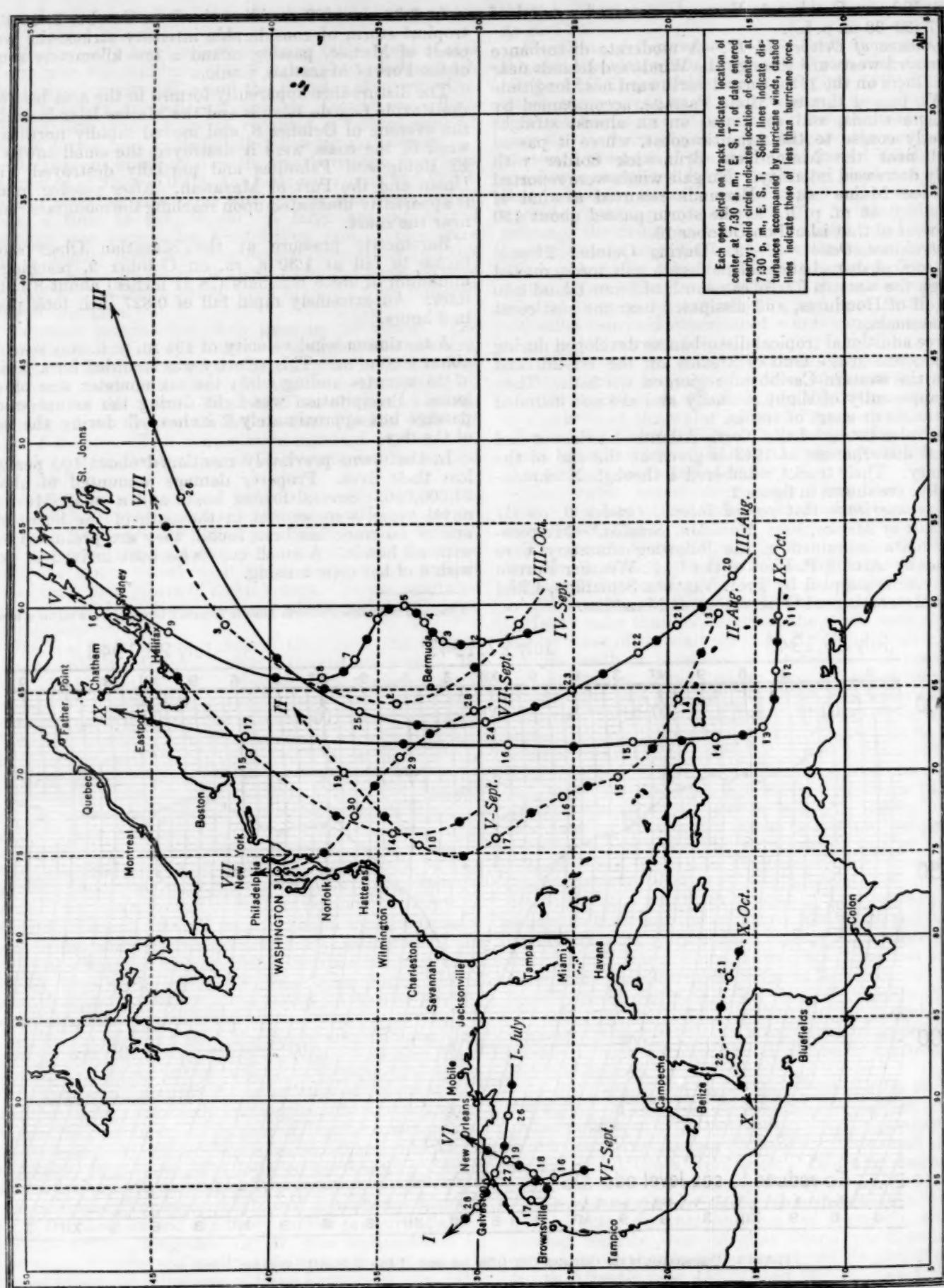


FIGURE 2.—Tracks of North Atlantic Hurricanes and Tropical Disturbances of 1943.

NORTH ATLANTIC HURRICANES AND TROPICAL DISTURBANCES OF 1943

[Number of storm in table corresponds to number of path on accompanying chart]

Storm	Date	Place where first reported	Coast lines crossed	Maximum wind velocity reported	Lowest barometer reported	Place of dissipation	Intensity	Remarks
I.....	July 26-28.....	North-central Gulf of Mexico.	Texas.....	104 miles per hour at Texas City, Tex.	980 millibars (28.95 inches) at Houston Airport and Galveston city office.	Southern Texas.....	Full hurricane.....	Most severe hurricane in Galveston area since 1915. Nineteen lives lost in Texas and at sea off Texas coast. Total estimated damage in southern Texas, \$16,550,000.
II.....	Aug. 13-19.....	Near Virgin Islands.	None.....	40 miles per hour, at sea.	No data ¹	North Atlantic Ocean.	Not of hurricane intensity.	Passed considerable distance east of Hatteras on 18th-19th.
III.....	Aug. 20-26.....	East of Lesser Antilles.	do.....	Beaufort force 12 (above 75 m. p. h.) from south at Bermuda on Aug. 24 at 7:30 p. m. (E. S. T.).	1002 millibars (29.59 inches) at Bermuda on Aug. 24-12 noon (E. S. T.).	do.....	Full hurricane.....	No reports of damage have been received.
IV.....	Sept. 11-19.....	Southeast of Bermuda.	Newfoundland.	No data.....	No data.....	Newfoundland.....	do.....	Accompanied by a large area of hurricane winds and gales. No damage reported.
V.....	Sept. 14-16.....	North of Bahama Islands.	Skirted Nova Scotia.	do.....	do.....	Near Newfoundland.	Not of hurricane force.	Developed gale intensity near 32° N. 72° W.
VI.....	Sept. 15-19.....	West-central Gulf of Mexico.	Louisiana.....	62 miles per hour NE., Freeport, Tex.	1010.5 millibars (29.84 inches) at Freeport, Tex.	Southwestern Louisiana.	Probably of hurricane intensity at sea.	Large percentage of damage from excessive rains and resultant flooding. No loss of life or serious injury reported.
VII.....	Sept. 28-Oct. 1.....	Near Bermuda.....	Maryland and Virginia.	No data.....	No data.....	Maryland.....	Not of hurricane intensity.	Estimated damage Norfolk-Cape Charles area, property \$5,000, crops \$15,000.
VIII.....	Oct. 1-3.....	Southeast of Bermuda.	None.....	do.....	do.....	North Atlantic Ocean.	do.....	Winds of gale force probably developed at sea.
IX.....	Oct. 11-17.....	East of Lesser Antilles.	Northern New England.	Beaufort force 8 (39-46 m. p. h.) from south at Bermuda on Oct. 16 at 7:30 p. m. (E. S. T.). ²	do.....	New Brunswick, Canada.	Full hurricane.....	No ship losses or damage reported.
X.....	Oct. 21-22.....	Caribbean Sea south of Swan Island.	Guatemala.....	No data.....	do.....	Eastern Guatemala.	Not of hurricane intensity.	Attended by winds of gale force, no reports of damage.

¹ Restriction of radio reports has resulted in a scarcity of data on storms that expended their greatest energy over water surfaces without seriously affecting coastal areas.² Higher wind velocities undoubtedly occurred at sea but records are not available.

METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR NOVEMBER 1943

[Climate and Crop Weather Division, J. B. Kincer, in charge]

AEREOLOGICAL OBSERVATIONS

NOTICE.—Effective with the December 1942 issue, the publication of table 1 (RAOB summaries) was discontinued indefinitely.—EDITOR.

TABLE 2.—Free-air resultant winds based on pilot-balloon observations made near 5 p. m. (75th meridian time) during November 1943. Directions given in degrees from North ($N=360^\circ$, $E=90^\circ$, $S=180^\circ$, $W=270^\circ$). Velocities in meters per second.

Altitude (meters) m. s. l.	Abilene, Tex. (538 m.)			Albuquerque, N. Mex. (1,630 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (512 m.)			Boise, Idaho (870 m.)			Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burling- ton, Vt. (132 m.)			Charles- ton, S. C. (17 m.)			Cincin- nati, Ohio (152 m.)			Denver, Colo. (1,627 m.)		
	Observations			Observations			Observations			Observations			Observations			Observations			Observations			Observations			Observations			Observations			Observations					
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity				
Surface.....	20	240	1.6	30	230	0.6	29	298	2.2	29	249	3.3	28	293	2.1	30	320	0.5	28	71	3.2	27	242	3.6	29	228	1.2	29	329	2.3	29	42	1.6	30	36	0.9
500.....	20	234	2.4	-	-	-	29	291	2.5	-	27	306	5.0	30	65	0.3	26	74	3.4	27	247	6.4	29	230	4.2	29	326	1.6	30	28	2.8	29	30	140	0.6	
1,000.....	20	234	3.4	-	-	-	28	298	4.7	29	266	6.4	21	302	7.4	30	206	0.4	17	294	9.4	27	207	1.4	21	251	1.0	12	279	8.5	15	252	9.6	10	258	2.1
1,500.....	28	258	3.7	30	230	0.9	28	292	7.4	28	286	8.0	17	294	9.4	27	207	1.4	21	251	1.0	12	279	8.5	15	252	9.6	10	258	2.1	28	224	0.8			
2,000.....	28	258	5.2	30	273	1.8	28	288	8.7	28	291	11.9	16	296	11.1	25	240	3.2	19	218	2.3	-	251	0.9	15	252	9.6	10	258	1.6	28	216	2.1			
2,500.....	28	264	5.2	30	273	1.5	28	288	8.7	28	291	11.9	16	296	11.1	25	240	3.2	19	218	2.3	-	251	0.9	15	252	9.6	10	258	1.6	28	239	2.5			
3,000.....	27	268	5.5	30	285	3.1	25	281	9.2	27	295	10.1	15	300	13.1	25	250	4.3	18	358	1.4	-	251	0.9	15	252	9.6	10	258	1.6	28	270	6.3			
4,000.....	24	285	6.4	29	280	5.9	22	289	10.4	25	300	11.9	14	295	15.6	20	249	3.6	17	278	5.0	-	251	0.9	15	252	9.6	10	258	1.6	28	255	4.7			
5,000.....	22	285	8.1	26	286	7.5	21	284	10.9	24	303	13.1	14	293	17.2	17	278	5.0	16	268	6.9	-	251	0.9	15	252	9.6	10	258	1.6	28	288	4.7			
6,000.....	19	296	10.4	26	295	8.4	18	290	11.6	24	308	13.3	12	295	19.9	15	291	7.6	15	277	9.4	-	251	0.9	15	252	9.6	10	258	1.6	28	284	8.9			
8,000.....	18	296	12.1	23	302	10.2	14	277	9.7	17	304	15.5	-	10	326	9.5	11	275	9.8	-	251	0.9	15	252	9.6	10	258	1.6	28	284	5.8					
10,000.....	-	-	-	18	293	10.3	11	311	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
12,000.....	-	-	-	10	307	11.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				

Altitude (meters) m. s. l.	Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,413 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)			Jackson- ville, Fla. (16 m.)			Joliet, Ill. (178 m.)			Las Vegas, Nev. (573 m.)			Little Rock, Ark. (88 m.)			Medford, Oreg. (410 m.)			Miami, Fla. (15 m.)			Mobile, Ala. (66 m.)			Nashville, Tenn. (194 m.)			New York, N. Y. (15 m.)					
	Observations			Observations			Observations			Observations			Observations			Observations			Observations			Observations			Observations			Observations			Observations											
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity										
Surface.....	30	310	0.8	29	320	2.1	30	260	2.0	29	270	2.0	30	39	2.9	29	269	2.8	30	53	1.5	30	253	0.9	30	347	0.5	29	56	2.7	28	354	1.5	29	262	1.3	30	296	2.9			
500.....	-	-	-	30	254	2.7	-	30	253	2.7	-	30	33	2.3	29	272	4.2	-	30	256	1.8	30	331	0.5	29	53	6.1	29	27	2.2	29	281	3.5	29	27	2.2	29	289	6.2			
1,000.....	-	-	-	29	249	4.2	29	257	4.3	28	291	9.1	27	271	8.5	28	292	3.5	17	274	10.9	27	291	6.8	27	203	3.5	25	234	4.6	27	208	2.6	28	238	5.0	24	287	6.6			
1,500.....	-	-	-	30	326	2.1	29	277	6.0	29	268	6.9	28	304	2.4	20	280	8.9	30	35	1.7	28	290	4.8	28	183	3.0	26	338	2.6	28	274	5.0	24	287	6.6						
2,000.....	-	-	-	30	307	0.9	29	311	1.7	27	271	9.1	27	271	8.5	28	293	3.5	17	274	10.9	27	291	6.8	27	203	3.5	25	234	4.6	27	208	2.6	28	238	5.0	24	287	6.6			
2,500.....	-	-	-	30	257	0.5	28	267	1.5	26	289	10.7	24	280	8.9	26	297	4.4	14	281	12.4	30	346	0.8	25	285	7.7	24	215	2.8	26	317	3.4	24	287	6.6						
3,000.....	-	-	-	29	181	0.6	28	261	2.8	26	284	12.4	22	287	10.1	20	297	5.2	14	283	14.8	30	321	1.2	25	292	8.3	20	196	1.6	28	250	2.2	19	311	4.2	20	290	10.7	11	200	11.4
4,000.....	-	-	-	24	312	3.1	19	297	4.3	18	281	14.7	17	297	12.0	20	276	7.7	-	27	301	2.5	23	299	9.6	17	235	2.7	16	256	5.1	13										

TABLE 3.—Maximum free-air wind velocities (m. p. s.), for different sections of the United States, based on pilot-balloon observations during November, 1943.

Section	Surface to 2,500 meters (m. s. l.)				Between 2,500 and 5,000 meters (m. s. l.)				Above 5,000 meters (m. s. l.)							
	Max. velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Max. velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Max. velocity	Direction	Altitude (m.) m. s. l.	Date	Station	
Northeast ¹	41.7	n.	1,580	24	Philipsburg, Pa.	42.6	nw.	5,000	12	Boston, Mass.	49.6	w.	6,980	20	Philipsburg, Pa.	
East Central ²	37.9	wnw.	2,500	13	Raleigh, N. C.	58.4	ssw.	4,850	8	Huntington, W. Va.	64.0	ssw.	5,660	8	Huntington, W. Va.	
Southeast ³	29.8	sw.	2,090	9	Charleston, S. C.	43.6	sw.	3,600	8	Atlanta, Ga.	60.0	w.	18,150	20	Jacksonville, Fla.	
North Central ⁴	43.2	nw.	1,430	18	Duluth, Minn.	59.6	nw.	4,900	12	St. Paul, Minn.	73.8	wnw.	12,420	20	Detroit, Mich.	
Central ⁵	35.6	ssw.	2,500	17	Joliet, Ill.	45.5	nw.	4,500	12	St. Louis, Mo.	72.0	nw.	7,660	12	St. Louis, Mo.	
South Central ⁶	31.0	ww.	2,360	8	Texarkana, Ark.	44.7	wsw.	4,150	7	Houston, Tex.	67.0	w.	15,050	28	Bis Spring, Tex.	
Northwest ⁷	33.8	sw.	1,640	29	Eugene, Oreg.	48.0	wnw.	4,600	5	Burns, Oreg.	67.0	nw.	8,520	5	Medford, Oreg.	
West Central ⁸	27.7	w.	2,490	5	Cheyenne, Wyo.	46.8	nnw.	4,280	6	Modena, Utah	66.0	nnw.	5,540	6	Modena, Utah.	
Southwest ⁹	25.3	se.	770	16	Bakersfield, Calif.	40.0	nw.	5,000	6	Winslow, Ariz.	73.0	wsw.	12,230	3	Phoenix, Ariz.	

¹ Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.

² Delaware, Maryland, Virginia, West Virginia, southern Ohio, Kentucky, eastern Tennessee, and North Carolina.

³ South Carolina, Georgia, Florida, and Alabama.

⁴ Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.

⁵ Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.

⁶ Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.

⁷ Montana, Idaho, Washington, and Oregon.

⁸ Wyoming, Colorado, Utah, northern Nevada, and northern California.

⁹ Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

RIVER STAGES AND FLOODS

By C. R. JORDAN

PRECIPITATION during November was below normal over most of the country. The northeastern States, and Mississippi, Alabama, Michigan, Wisconsin, and Minnesota were the only ones that had above normal precipitation. The greatest deficiencies reported for November were in the far Southwest, the Central and Southern Plains, and the lower Missouri Valley. Arkansas had the driest November since 1910, and Arizona and Oklahoma since 1932.

The dry weather that has persisted over most of the country for 3 or 4 months is reflected in subnormal stream flow; very little flooding occurred during November.

Moderate to heavy rains over the northeastern States on November 8 and 9, with 24-hour amounts as great as 4 inches, produced light flooding in some streams in that area.

Atlantic Slope Drainage.—Slight damage was caused by high water in the Kennebec and Androscoggin Valleys on November 9 and 10. No towns were affected but a number of fields were overflowed.

A sharp rise in stages occurred in the headwater tributaries of the Merrimack Basin on November 9 as a result of the rain which began in that area on the morning of the 8th. The rise in both the Pemigewasset and Bakers Rivers was very rapid and bankful stages were reached above Bristol, N. H. Water overflowed farm land and roads at a few scattered places but no important damage resulted.

Precipitation resulting from the same storm over the Connecticut River Valley caused a rise in that stream and flood stage at Hartford, Conn., was exceeded slightly from November 10 to 12. Minor flooding occurred at a few low places in the vicinity of Hartford, but damage was confined principally to inconvenience to construction work along the main river and in the channel of the Park River at Hartford. River traffic was slowed to some extent but not disrupted during the high-water period.

The Lehigh River at Lehighton, Pa., and the Schuylkill River at Reading and Philadelphia, Pa., were slightly above flood stage on November 9.

Pacific Slope Drainage.—Moderate to heavy rain fell along the Oregon coast on November 4 and 5 and produced some light flooding along the McKenzie River at Leaburg, Oreg., and along the Santiam River in the vicinity of Jefferson, Oreg. No damage was reported.

FLOOD-STAGE REPORT FOR NOVEMBER 1943

[All dates in November]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
Bakers: Rumney, N. H.	Feet	8	9	9	8.4 9
Pemigewasset:					
Woodstock, N. H.		10	9	9	11.1 9
Plymouth, N. H.		11	9	10	15.6 9
Connecticut: Hartford, Conn.		16	10	12	17.1 11
Lehigh: Lehighton, Pa.		9	9	9	12.3 9
Schuylkill:					
Reading, Pa.		13	9	9	15.1 9
Philadelphia, Pa.		11	9	9	11.2 9
PACIFIC SLOPE DRAINAGE					
Columbia Basin					
McKenzie: Leaburg, Oreg.		12	4	5	13.7 4
Santiam: Jefferson, Oreg.		13	5	5	14.2 5

ESTIMATED FLOOD LOSSES AND SAVINGS FOR 1941¹

BY BENNETT SWENSON

The monetary losses from floods during the year 1941 have been estimated at nearly \$40,000,000 and a total of 47 lives were lost. The savings, as the result of the flood forecasting and warning service, are reported at about 7 million dollars. These losses and savings, shown in the table below, are somewhat below the average annual loss and saving for the period 1924 to 1941 of about \$90,000,000 and \$14,500,000 respectively.

Outstanding among the floods during 1941 were the series of floods in the interior of the country from New Mexico and Texas northeastward to Illinois and Wisconsin. These floods occurred intermittently from April through October, and were severe in portions of the Rio Grande, Arkansas, Missouri, and upper Mississippi River basins.

Generally, drought conditions prevailed east of the Mississippi River. West of the Mississippi, except in the Northwest, abundant precipitation and extensive flooding was the rule.

¹ Annual flood losses and savings for previous years have been published in the Monthly Weather Review as follows:

Year	Issue of Review	Pages
1933	Vol. 62, No. 1, Jan. 1934.	25-27
1934	Vol. 62, No. 12, Dec. 1934.	465-467
1935	Vol. 63, No. 12, Dec. 1935.	362-365
1936	Vol. 65, No. 1, Jan. 1937.	28-31
1937	Vol. 66, No. 12, Dec. 1938.	426-430
1938	Vol. 68, No. 9, Sept. 1940.	262-263
1939	Vol. 68, No. 11, Nov. 1940.	529-530
1940	Vol. 69, No. 7, July 1941.	217-218

Prior to 1933 losses and savings have been published monthly, as a rule.

River and drainage	Tangible property	Matured crops	Prospective crops	Livestock and other movable farm property	Suspension of business	Total	Lives lost	Reported savings as the result of warnings
ATLANTIC SLOPE								
Neuse River.....	\$3,450				\$5,000	\$8,450		
Broad River (S. C.).....	1,000	\$6,500	\$1,800		500	9,800		\$5,000
Catawba-Wateree River.....	5,500	800	16,000	\$2,000	800	25,100		30,000
Santee River.....	12,000			2,500	41,000	45,500		20,000
EAST GULF OF MEXICO								
Tombigbee River.....	1,000				1,000	2,000		2,500
Pascagoula River.....					10,000	10,000		6,000
Pearl River.....					11,850	11,850		8,000
MISSISSIPPI SYSTEM								
<i>Upper Mississippi Basin</i>								
Chippewa River.....	951,000	20,000	10,000	10,000	10,000	1,001,000		250,000
Zumbro and Whitewater Rivers.....	2,215		285			2,500		
LaCrosse River and Coon Creek (Wis.).....	65,000		1,000			66,000		5,000
Root River (Minn.).....		2,000				2,000		
Wisconsin River.....	250,000	16,600	2,200	450	21,700	290,950		66,000
Turkey and other rivers in northeast Iowa.....	579,500	6,000	307,450	51,800	1,000	945,730		5,000
Wapsipinicon and Maquoketa Rivers (Iowa).....	128,000	165,000	337,000	10,000	1,000	641,000		2,000
Des Moines River.....		2,000				2,000		
Mississippi River above Cairo, Ill.....	48,000	6,000	1,000	10,000	2,000	67,000		7,000
<i>Ohio Basin</i>								
Allegheny River.....	20,000					20,000		25,000
Monongahela River.....	730,000		100,000			830,000		1,000,000
Licking River.....	*25,000					25,000		
Wolf and Obey Rivers (Tenn.).....			200,000			200,000		
Black and Orchard Creeks (Tenn.).....	100		2,050			2,150		
Ohio River.....	40,000		5,000			45,000		50,000
<i>White Basin</i>								
White River.....	38,700	160,800	43,200	5,400	15,000	263,100		90,000
<i>Arkansas Basin</i>								
Cow Creek.....						595,000		
Walnut River (Kans.).....	75,000	90,000	10,000	1,000	500	176,500		25,000
Streams in southwest Missouri.....						*1,000,000	4	
Neosho River (Kans.).....	722,000	1,603,500	772,250	86,200	63,950	3,247,900		1,140,300
North Canadian River.....	1,622,500	421,300	690,100	91,750	83,250	2,908,900		53,500
Canadian River.....	535,300	555,000	156,300	76,200	14,900	1,337,700	5	21,000
Petit Jean River.....	100				500	600		350
Lower Neosho and Arkansas Rivers.....	469,500	100,000	*2,847,400	233,400	166,100	3,816,400		961,600
<i>Missouri Basin</i>								
Milk River.....						10,000		
Solomon River.....	49,000	185,500	66,000	7,950	5,500	313,950		25,000
Smoky Hill River.....	262,000	465,000	202,000	93,500	26,600	1,048,100	2	52,000
Republican River.....	792,180		*1,203,380	14,700	91,300	2,101,560		
Big Blue River.....	888,000	550,000	434,120	69,000	68,000	1,979,120		225,000
Kansas River.....	226,850	1,442,400	758,250	286,000	210,400	2,923,900		600,500
Grand River (Mo.).....		30,000				30,000		3,000
Marmaton River (Kans.).....	1,500		1,600	3,000	1,000	7,100		
Osage River (Kans.).....	59,500	239,000	420,700	7,800	2,000	729,000		56,000
Lower Missouri River and tributaries.....	530,225	750,500	1,543,500	27,900	13,900	*2,870,025		216,000
<i>Red Basin</i>								
Washita River.....	355,150		*969,675			1,324,825		
Sulphur River.....	21,300	5,000	100,000	3,375	13,000	142,675		16,350
Ouachita River.....	2,750		12,000	1,450	5,500	21,700		21,500
Red River.....	104,000	38,500	207,000	4,100	12,500	366,100		46,000
<i>WEST GULF OF MEXICO</i>								
Trinity River.....	66,680	192,860	532,700	10,700	95,170	907,110		381,670
Hubbard Creek.....	106,000					106,000	12	
Brazos River.....	30,300		100,000			130,300		
Colorado River (Tex.).....		3,000				3,000		
Guadalupe River.....	8,000		75,000	3,500	14,000	100,500		19,500
Nueces River.....	2,500		4,600	350	1,800	9,250		1,400
Pecos River.....	645,830	91,000	*499,000	15,000	3,700	*3,227,910	21	256,000
Rio Grande River.....	441,170	51,000	236,200	24,075	221,460	973,905	1	1,514,000
<i>Colorado Basin</i>								
Little Colorado River.....							2	
Gunnison and Colorado Rivers.....	36,000		84,000			120,000		
Salt River.....	196,300					196,300		5,000
Gila River.....						745,200		
<i>PACIFIC SLOPE</i>								
San Joaquin River.....	8,000	2,130	20,000			30,130		
Sacramento River.....	712,800	60,600	460,000	2,000	55,500	1,200,900		110,000
Eel River.....	66,000					66,000		5,500
Willamette River.....	28,400		*107,900	4,200	3,000	*145,000		
TOTAL						39,524,600	47	7,330,870

¹ Does not include \$20,000 damage to highways thru state due to high water in small streams.

² Furnished by U. S. Engineer Office.

³ From press reports.

⁴ \$2,332,400 of which represents all crop loss.

⁵ Including matured crops.

⁶ Including losses of \$10,000 which were not classified.

⁷ Including losses of \$1,973,380 which were not classified.

⁸ Including losses of \$1,500 which were not classified.

⁹ \$200,000 of which represents all crop loss.

CLIMATOLOGICAL DATA

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS

[For description of tables and charts, see REVIEW January 1942, p. 15]

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Section	Temperature								Precipitation							
	Section average	Departure from the normal	Monthly extremes						Section average	Departure from the normal	Greatest monthly		Least monthly			
			Station	Highest	Date	Station	Lowest	Date			Station	Amount	Station	Amount		
Alabama	52.3	-2.0	Eufaula	87	1	Valley Head	18	17	3.44	+0.03	Frisco City	11.49	Bridgeport	1.03		
Arizona	51.0	+.4	Ehrenberg	93	3	Alpine	3	30	.04	-.94	Betatakin	.62	100 stations	.00		
Arkansas	49.6	-.6	Fordyce	88	1	4 stations	15	30	1.10	-2.61	Monticello	3.30	Fort Smith Wtr. P.	.10		
California	52.9	+1.2	El Cajon	94	6	Bridgeport (near)	8	5	.45	-1.43	Crescent City (near)	10.99	22 stations	.00		
Colorado	36.0	+.8	Box Ranch	85	18	2 stations	-17	126	.48	-.25	Wolf Creek Pass	3.61	2 stations	.00		
Florida	63.3	-1.7	Davenport	92	6	Vernon	21	18	1.88	-.28	Tavernier	11.40	Cedar Key	.00		
Georgia	52.6	-1.7	Camilla	90	1	Blairsville	13	24	2.17	-.41	Goat Rock	4.52	Brunswick	.22		
Idaho	36.5	+.1	Twin Falls Factory	70	17	Landmark	-13	7	.92	-1.13	Deception Creek	3.30	Howe	T		
Illinois	39.1	-3.0	East St. Louis	79	18	Danville	10	28	1.74	-.88	Marshall	3.27	4 stations	.64		
Indiana	39.7	-2.6	Tell City	82	1	4 stations	12	14	2.02	-1.03	La Porte	3.87	2 stations	.72		
Iowa	33.8	-2.5	6 stations	72	18	Forest City	1	16	1.01	-.59	Fort Dodge	2.05	Clarinda Erosion	.32		
Kansas	42.5	-.7	2 stations	82	17	2 stations	9	29	.22	-1.04	Horton	.79	Garden City	.00		
Kentucky	44.5	-1.9	Russellville	85	1	do	13	17	1.33	-2.05	Murray	3.17	Valley View	.41		
Louisiana	55.1	-3.7	Houma	87	1	Tallulah	21	30	3.79	-.05	Lake Arthur	11.58	Paradis	.38		
Maryland-Delaware	44.2	-1.0	Friendsville, Md.	76	1	Oakland, Md.	10	29	2.07	+.42	Takoma, Md.	5.16	Solomons, Md.	1.25		
Michigan	34.1	-2.2	Monroe	71	1	Watersmeet	-7	29	2.88	+.35	Mancelona	5.52	Jackson	1.43		
Minnesota	27.6	-2.0	3 stations	57	13	Taylor Falls	-12	16	1.31	+.16	Springfield	3.37	Foxton	.20		
Mississippi	52.2	-2.8	2 stations	85	1	3 stations	20	17	3.90	+.32	Merrill	7.95	Durant	1.58		
Missouri	42.7	-1.7	Caruthersville	81	1	Grant City	9	16	.93	-1.75	Warrenton	2.27	2 stations	.09		
Montana	34.5	+.2	Hardin	76	17	2 stations	-8	17	.52	-.51	Heron	1.78	4 stations	T		
Nebraska	37.4	+.1	Culbertson	81	17	Scottsbluff	3	16	.29	-.45	Osmond	1.20	3 stations	.00		
Nevada	40.9	+.9	Desert Game Range	83	16	Buffalo Valley Airport	-4	1	.50	-.16	Lehman Caves	1.40	4 stations	.00		
New England	37.2	-.8	Plymouth, Mass.	70	9	Lake Frontiere, Maine	-5	30	5.13	+.162	Pinkham Notch, N. H.	14.16	Provincetown, Mass	1.91		
New Jersey	42.4	-1.3	Canoe Brook	73	8	Runyon	11	29	2.89	-.31	Newton	4.24	Barnegat City	.20		
New Mexico	41.3	-1.2	Obar	88	10	Eagle Nest	-22	30	.46	-.18	Tularosa	1.54	3 stations	.00		
New York	36.2	-1.9	Avon	73	11	2 stations	-4	17	3.41	+.40	Cherryplain	6.80	Wilson	1.10		
North Carolina	48.7	-1.3	3 stations	82	6	Mount Mitchell	8	11	1.61	-.01	Hendersonville	4.20	Clinton	.30		
North Dakota	28.7	+.1	Mott	63	17	3 stations	-4	15	.44	-.14	Milnor	1.45	Dunseith	T		
Ohio	39.4	-2.1	Gallipolis (near)	84	1	McArthur	9	28	1.23	-.46	Jefferson	2.32	Portsmouth (2)	.44		
Oklahoma	49.3	-.4	Crescent	88	19	Kenton	10	28	.39	-.62	Idabel	2.48	4 stations	.00		
Oregon	40.9	+.5	Powers	73	28	Round Grove	4	26	1.80	-.189	Ilahe	10.76	Hart Mountain	.00		
Pennsylvania	38.7	-2.6	3 stations	79	1	2 stations	7	29	2.87	+.01	Mauch Chunk	7.02	Pittsburgh	.99		
South Carolina	51.8	-1.9	2 stations	86	1	4 stations	20	12	1.84	-.47	Caesars Head	3.62	Columbia	.76		
South Dakota	33.3	+.1	Pukwana	78	17	Camp Crook	-1	27	.55	-.06	Dumont	2.42	Hot Springs	.00		
Tennessee	46.7	-1.8	2 stations	86	1	Waynesboro	10	17	2.22	-1.28	Milan	5.13	Charleston	1.05		
Texas	54.9	-2.2	do	93	6	Muleshoe	12	27	2.11	-.07	Houston	14.10	Trinidad	.00		
Utah	38.1	+.7	do	78	15	Silver Lake (Brighton)	-4	7	.54	-.41	Yellowstone Ranger Sta.	3.20	Wendover	T		
Virginia	46.0	-.6	Clarksville	83	1	2 stations	12	12	2.04	-.37	Gordonville	6.84	Martinsville	.71		
Washington	40.6	+.1	2 stations	71	15	Plain	11	1	1.85	-.05	Snoqualmie Pass	8.93	White Swan	T		
West Virginia	41.1	-2.1	do	83	1	Thornwood	2	12	2.12	-.62	Cranberry Glades	4.40	Brandywine	.47		
Wisconsin	30.0	-3.3	do	62	18	3 stations	-10	13	2.06	+.21	Mellen	4.96	Platteville	.85		
Wyoming	34.0	+.2	do	71	17	Northeast Entrance	-10	7	.46	-.26	Beecher River	2.14	5 stations	T		
Alaska (October)	33.5	+.3	Sitka	67	7	Allakaket	-37	30	3.66	+.07	Little Port Walter	35.20	Point Lay	.00		
Hawaii	72.8	+.9	2 stations	92	14	Volcano Observatory	42	26	2.47	-.57	Honomale (Mauka)	15.43	12 stations	.31		
Puerto Rico	76.8	+.1	Guayama	95	15	Guineo Reservoir	53	22	3.01	-.43	San German	12.98	Santa Isabel	.31		

¹ Other dates also.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS

District and station	Elevation of instruments				Pressure		Temperature of the air						Precipitation			Wind			0-10 In.	6.1 In.	Total snowfall at end of month Number of days with thunderstorms											
	Barometer above sea level		Thermometer above ground	Anerometer above ground	Station	Sea level	Departure from normal		Mean maximum + 2 min.	Mean minimum	Date	Greatest daily range	Mean temperature of the dew-point	Mean relative humidity	Total	Days with 0.01 inch or more	Average hourly velocity	Miles per hour	Maximum velocity													
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.	°F.	Date	°F.	°F.	%	In.	In.	Miles	Direction	Date	Clear days	Partly cloudy days	Cloudy days										
New England							40.0	+0.4	38.2 +1.5	57	9	43	21	18	35	18	33	81	7.59 +4.3	17	11.7	w.	42	ne.	22	5	6	19	7.5	2.5	0.0	0
Eastport	75	67	85	20.03	30.03	+0.02	38.2	+1.5	57	9	43	21	18	35	18	33	81	7.59 +4.3	17	11.7	nw.	42	ne.	22	2	8	20	32.8	15.0	1		
Greenville, Maine	1,070	6	41	28.85	30.05		31.0	-3	61	9	39	0	29	23	31	26	28	6.68 +3.6	17	11.7	n.	38	n.	23	11	9	10	5.4	13.4	1.6	1	
Portland, Maine ¹	103	5	45	29.91	30.04	+0.03	37.4		60	9	46	13	29	28	35	31	85	5.56 +2.1	14	8.8	n.	25	ne.	22	9	8	13	6.2	14.9	1.5	0	
Concord ¹	289	4	45	29.72	30.06		36.7	-1.3	66	9	47	12	29	27	38	28	80	4.38 +1.3	11	6.6	s.	32	s.	19	1	10	19	7.9	11.6	2.7	0	
Burlington ¹	403	6	51	29.59	30.05		35.0	-1.3	62	8	42	10	29	28	29	28	83	3.29 +2.6	11	9.7	s.	39	sw.	9	8	9	13	6.2	T	0	2	
Boston ¹	124	33	62	29.89	30.04	-0.01	43.3	-1.3	67	9	50	24	29	36	23	32	70	2.16 -1.2	12	11.6	nw.	25	ne.	24	7	12	11	6.2	T	0	1	
Nantucket ¹	12	11	59	30.01	30.04	-0.01	45.8	+1.4	62	9	52	30	18	40	21	39	81	5.00 -3.3	11	10.6	n.	34	s.	9	9	10	11	5.7	4.6	0	0	
Block Island ¹	26	11	46	30.02	30.06	-0.00	45.2	+1.6	64	9	51	27	29	39	20	36	72	2.92 -7	11	17.6	n.	45	nw.	13	12	9	9	4.6	T	0	1	
Providence ¹	159	46	60	28.88	30.07	-0.00	43.7	+3.3	66	9	51	24	29	36	28	32	76	2.62 -7	12	8.8	n.	34	s.	9	9	10	11	5.7	4.6	0	0	
Hartford ¹	159	5	44	29.89	30.08	-0.00	39.8	+3	67	9	50	20	18	30	35	30	77	4.32 +8	11	8.3	n.	28	sw.	9	9	11	10	5.7	4.6	0	0	
New Haven ¹	107	5	39	29.95	30.09	+0.02	41.2	+1.3	64	9	50	20	18	32	30	73	3.30 +2	11	7.6	n.	28	sw.	9	9	11	10	5.7	4.6	0	0		
Middle Atlantic States							44.5	-0.2									70	2.69 +0.2											5.2			
Albany ¹	97	26	40	29.95	30.07	-0.01	36.0	-3	64	8	43	10	29	29	28	29	80	3.23 +8	10	8.2	s.	27	nw.	27	4	9	17	7.2	16.9	2.1	0	
Binghamton ²	871	60	79	29.13	30.11	+0.02	36.9	-1.8	66	8	45	12	17	29	23	28	80	3.12 +7	12	5.8	w.	17	se.	8	4	8	18	7.4	6.0	0	0	
New York	314	415	454	29.73	30.09	-0.00	44.8	+1.6	65	9	52	26	17	38	26	32	64	1.97 -1.0	9	16.1	nw.	48	s.	9	12	9	10	5.1	T	0	1	
Harrisburg ¹	374	30	49	29.71	30.13	+0.02	41.7	-1.1	67	8	50	21	29	33	21	69	3.72 +1.5	6	7.9	nw.	29	nw.	13	2	13	15	6.8	T	0	1		
Philadelphia ¹	114	6	56	29.98	30.12	+0.02	43.9	-0	60	8	53	25	17	34	33	72	3.72 +1.0	7	9.1	nw.	34	nw.	22	7	14	9	5.9	T	0	1		
Reading ¹	323	47	306	29.76	30.13	-0.00	43.2	-6	70	8	52	23	29	35	32	34	3.49 +8	6	11.6	nw.	40	se.	8	5	11	14	6.3	T	0	1		
Scranton ¹	805	72	104	29.22	30.11	+0.02	38.6	-1.9	67	8	46	19	29	31	30	33	3.14 +4	10	6.0	n.	24	nw.	27	5	8	17	6.8	1.7	0	1		
Atlantic City ¹	52	37	172	29.04	30.11	+0.01	46.2	+1.6	65	8	54	28	29	38	26	37	74	2.95 +1	8	15.6	w.	43	s.	8	13	11	6	4.5	T	0	1	
Trenton ¹	190	89	107	29.89	30.11	-0.00	44.0	-4	70	8	53	26	17	36	31	33	71	2.80 +1	8	9.3	nw.	31	nw.	27	7	17	6	5.2	0	0	0	
Baltimore ¹	123	100	215	29.99	30.14	+0.03	47.0	+1.7	70	19	55	29	39	31	32	65	2.77 +2	7	9.8	nw.	34	nw.	23	12	13	5	4.5	0	0	1		
Washington ¹	112	56	100	30.00	30.14	+0.02	46.6	+1.4	72	8	56	28	17	37	36	32	63	2.43 +1.9	7	7.7	nw.	29	w.	13	10	12	8	3.3	T	0	1	
Cape Henry ¹	18	8	54	30.10	30.14	-0.00	50.4	-1.7	75	8	58	32	17	43	28	38	68	1.47 -9	7	13.7	n.	41	nw.	11	19	8	8	3.3	T	0	1	
Lynchburg ¹	686	144	184	29.40	30.15	+0.02	48.0	+8	77	6	60	25	18	36	40	31	59	1.75 -1.6	5	7.6	nw.	30	nw.	22	17	7	6	3.0	0	0	0	
Norfolk ¹	91	80	125	30.04	30.16	+0.03	51.5	+1	75	2	60	34	30	43	30	76	1.36 -8	6	10.2	n.	31	nw.	11	16	8	6	3.5	T	0	3		
Richmond ¹	144	11	52	29.97	30.14	+0.02	48.6	+3	75	8	60	28	14	37	38	34	67	1.70 -5	8	8.4	sw.	30	sw.	8	16	8	6	3.5	3	0	1	
South Atlantic States							53.2	-0.9									70	1.62 -0.8											3.5			
Asheville ¹	2,253	77	92	27.79	30.20	+0.06	44.7	-4	74	1	57	21	12	32	41	30	65	1.62 -6	3	8.0	nw.	23	nw.	11	15	7	8	4.4	0	0	0	
Charlotte ¹	779	63	86	29.31	30.16	+0.03	51.3	+7	78	1	63	27	12	40	34	34	67	1.00 -1.6	3	6.6	sw.	19	sw.	8	17	7	6	3.6	0	0	0	
Greensboro ¹	886	6	56	29.20	30.19	-0.00	46.4		75	19	61	17	12	32	44	31	67	1.37 -1	3	7.8	sw.	26	sw.	8	18	8	4	3.2	T	0	0	
Hatteras ¹	11	5	50	30.12	30.14	+0.03	54.4	-1.9	75	8	61	35	18	47	28	46	79	3.35 -1	8	13.0	n.	34	n.	3	13	11	6	3.8	0	0	3	
Raleigh ¹	376	27	69	29.75	30.17	+0.04	49.5	-4	77	8	62	28	12	37	38	34	64	1.72 -6	5	8.4	sw.	30	nw.	11	15	11	4	3.4	T	0	1	
Wilmington ¹	72	73	107	30.08	30.17	+0.05	53.6	-2.4	77	8	64	31	12	43	30	41	72	1.25 -7	3	7.9	n.	25	nw.	3	17	10	8	3.1	0	0	0	
Charleston ¹	48	11	92	30.10	30.16	+0.04	53.4	-1.7	79	8	65	37	12	48	32	42	70	1.25 -9	3	9.1	n.	24	s.	8	17	9	4	3.2	0	0	1	
Columbia, S. C. ¹	349	70	91	29.79	30.17	+0.05	53.4	-6	81	1	66	30	12	41	35	39	73	1.76 -1.2	5	7.1	n.	22	w.	8	16	8	6	3.3	0	0	0	
Greenville, S. C. ¹	1,040	18	36	29.04	30.17	-0.00	50.2	+6	79	1	61	28	13	39	33	60	2.47 -7	2	8.0	sw.	34	n.	11</td									

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments				Pressure			Temperature of the air						Mean relative humidity	Precipitation			Wind			Maximum velocity	Prevailing direction	Miles per hour	Cloudy days	Clear days	Partly cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month	Number of days with thunderstorms			
	Barometer above sea level	Thermometer above ground	Anemometer above ground	Station	Sea level	Departure from normal	Mean max. + mean min. + 2	°F.	°F.	°F.	Departure from normal	Maximum Date	Mean maximum Date	Minimum Date	Greatest daily range	Mean temperature point down	Total	In.	In.	Departure from normal	Days with 0.01 inch or more	Miles	Date	Direction									
	Ft.	Ft.	Ft.	In.	In.										%																		
Ohio Valley and Tennessee								42.9	-1.1							73	1.56	-1.6															
Chattanooga ¹	762	6	66	29.35	30.20	+ .06	45.3	-1.6	77	1	61	22	12	32	45	34	75	1.29	-2.1	4	6.3	ne.	28	se.	7	16	7	7	3.6	.0	.0	1	
Knoxville ¹	905	27	53	29.12	30.20	+ .07	46.8	+ .3	80	1	59	25	12	34	41	32	67	2.02	-1.0	5	7.8	sw.	27	w.	9	17	8	5	3.5	.0	.0	0	
Memphis ¹	395	5	86	29.76	30.20	+ .08	48.8	-1.3	81	1	61	21	30	36	35	37	74	3.42	-8	5	7.7	sw.	24	w.	8	17	6	7	3.8	.0	.0	3	
Nashville ¹	546	5	72	29.60	30.16	+ .08	46.8	-2.2	82	1	59	22	17	35	36	34	70	1.61	-1.9	4	8.1	s.	31	se.	7	15	8	7	4.1	T	.0	1	
Lexington ¹	969	6	29.10	30.21	+ .09	43.4	-1.4	78	1	55	18	17	31	37	31	55	-2.8	6															
Louisville ¹	525	120	29.60	30.18	+ .06	44.5	-5	78	1	53	24	17	36	26	31	68	7.3	-2.9	5	8.7	s.	26	sw.	8	14	6	10	5.2	T	.0	0		
Evansville ¹	431	12	40	29.70	30.19	+ .07	42.8	-1.6	75	1	54	20	17	32	35	31	72	1.70	-2.0	8	8.0	sw.	27	nw.	8	13	10	7	4.8	.2	.0	2	
Indianapolis ¹	823	5	54	29.35	30.16	+ .06	37.9	-2.8	70	1	47	16	17	28	35	30	77	1.94	-9	9	10.7	sw.	12	s.	11	11	5.6	.2	.0	2			
Terre Haute ¹	575	68	149	29.54	30.19		40.6		71	1	49	23	17	32	32	30	78	2.38	-9	9	9.6	sw.	26	s.	7	13	9	8	4.8	.3	.0	2	
Cincinnati ¹	627	11	51	29.45	30.18	+ .06	42.5	.0	76	1	52	21	28	33	30	31	72	2.2	-1.1	6	8.0	sw.	21	s.	7	12	7	11	5.3	.2	.0	0	
Columbus ¹	822	90	210	29.26	30.16	+ .05	40.6	-1.3	73	1	49	14	13	30	32	28	71	1.15	-1.6	10	10.0	s.	29	sw.	8	5	8	17	7.1	1.2	.0	2	
Vandalia ¹	1,003	6	55	29.05	30.16	+ .07	39.0	-1.4	72	1	47	19	17	31	30	29	79	2.47	-9	1.9	10	11.6	nw.	32	w.	5	8	11	14	6.7	1.0	.0	0
Elkins ¹	1,947	61	78	29.07	30.19	+ .07	39.4	-9	72	1	50	16	19	29	30	29	73	1.23	-1.3	8	6.1	w.	21	sw.	15	4	8	18	7.2	4.1	.0	1	
Parkersburg ¹	637	77	84	29.46	30.17	+ .05	42.4	+1.4	70	1	52	19	14	32	35	32	71	1.58	-7	12	10.8	sw.	25	nw.	21	10	6	14	5.9	3.2	.0	1	
Pittsburgh ¹	842	39	54	29.21	30.14	+ .04	39.5	-1.7	75	1	45	22	30	32	27	28	71	1.58	-7	12	10.8	sw.	32	nw.	13	8	9	18	7.3	3.0	.0	2	
Lower Lake Region								37.8	-0.7							78	2.08	-6.8															
Buffalo ¹	768	34	96	29.24	30.09	+ .04	37.5	-1.0	71	1	44	20	29	31	31	31	80	2.57	-4	16	12.5	sw.	35	w.	27	3	9	18	7.4	13.6	.5	2	
Canton ¹	448	10	61	29.55	30.05		34.4	+ .5	65	8	41	9	29	27	33	29	82	2.49	-1.1	13	10.6	s.	35	n.	19	2	7	19	7.6	2.1	T	1	
Oswego ¹	335	71	85	29.32	30.08	+ .03	38.4	-5	64	7	44	20	17	33	28	30	72	3.24	-2	13	10.6	s.	35	n.	22	4	7	21	8.0	5.2	.5	1	
Rochester ¹	523	5	69	29.51	30.10	+ .05	37.0	+ .3	71	1	44	17	16	30	36	36	80	1.91	-6	11	9.4	w.	30	w.	19	2	7	21	8.0	5.2	.5	1	
Syracuse ¹	596	5	57	29.42	30.09	+ .03	37.2	.0	67	8	44	17	30	30	36	36	80	2.93	-1	16	10.0	sw.	30	se.	8	5	5	20	7.7	7.4	T	1	
Erie ¹	714	67	81	29.33	30.13	+ .07	39.9	-1.5	74	1	45	27	16	35	24	31	79	2.09	-1	16	9.0	sw.	25	s.	8	5	5	20	7.7	6.4	.0	0	
Cleveland ¹	762	27	54	29.26	30.13	+ .06	39.3	+ .3	73	1	46	22	17	33	28	30	76	1.21	-1.4	13	11.5	sw.	30	sw.	13	3	5	22	8.0	5.8	.0	1	
Sandusky ¹	629	5	67	29.42	30.13	+ .05	39.8	-1.3	71	1	46	22	17	33	28	29	79	1.50	-9	12	10.8	sw.	34	w.	8	3	7	20	7.7	2.0	.0	1	
Toledo ¹	628	5	47	29.42	30.13	+ .06	37.6	-1.1	68	1	46	17	29	30	32	29	79	1.50	-9	12	10.8	sw.	33	nw.	12	6	5	19	7.2	.2	.0	1	
Fort Wayne ¹	857	5	33	29.18	30.14		36.5	-2.3	67	1	45	18	14	28	36	28	77	1.90	-9	8	9.1	w.	33	nw.	12	6	5	19	7.2	.2	.0	1	
Detroit ¹	730	5	78	29.30	30.12	+ .06	38.2	-1.0	67	1	44	21	16	32	30	30	78	2.07	-4	10	10.4	w.	31	nw.	13	2	7	21	7.9	3.1	T	0	
Upper Lake Region								33.1	-1.4							81	2.42	0.0															
Alpena ¹	609	5	89	29.28	30.07	+ .06	34.8	+ .4	52	1	40	17	16	30	20	28	78	2.06	-1.5	16	10.4	sw.	35	se.	8	2	5	23	8.5	6.3	.0	0	
Escanaba ¹	612	61	72	29.40	30.10	+ .07	32.4	-7	53	1	39	12	29	26	27	26	82	1.66	-1.1	13	10.8	sw.	33	n.	10	5	7	18	6.8	5.6	T	0	
Grand Rapids ¹	707	70	244	29.32	30.12	+ .07	37.4	-1.0	60	1	43	23	17	32	26	29	82	2.34	-2	13	10.6	s.	35	n.	19	2	7	19	7.6	2.1	T	1	
Lansing ¹	878	5	90	29.13	30.11		35.2	-2.3	64	1	42	19	16	29	26	26	81	2.16	-3	10	8.6	sw.	24	sw.	8	6	2	22	7.8	3.1	.0	1	
Marquette ¹	734	44	73	29.25	30.08	+ .06	32.1	-1.2	51	1	37	12	29	27	21	26	82	4.14	+1.2	19	8.6	w.	29	nw.	18	4	4	22	8.0	11.7	.9	0	
Sault Sainte Marie ¹	614	11	52	29.36	30.05	+ .04	31.2	+ .8	50	8	36	14	29	26	18	27	85	3.91	+ .9	23	10.6	nw.	39	w.	19	8	8	22	8.5	27.7	1.1	0	
Chicago ¹	673	5	36	29.38	30.14	+ .07	36.2	-2.1	51	1	46	20	25	28	25	29	78	1.39	-1.1	8	9.6	nw.	29	nw.	12	6	8	16	7.0	.2	0	0	
Green Bay ¹	617	109	141	29.42	30.12	+ .08	31.8	-2.2																									

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments				Pressure								Temperature of the air								Precipitation				Wind													
	Barometer above sea level		Thermometer above ground		Anemometer above ground		Station		Sea level		Departure from normal		Mean max. + mean min. + 2		Departure from normal		Mean maximum		Mean minimum		Greatest daily range		Mean relative humidity		Total		Departure from normal		Days with 0.01 inch or more		Average hourly velocity		Maximum velocity					
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	in.	in.	ft.	ft.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	in.	in.	miles	in.	in.	direction	date	clear days	cloudy days	average cloudiness, tenths	total snowfall	snow, sleet, and ice on ground at end of month	number of days with thunderstorms					
Middle Slope																																						
Denver ¹	5,292	106	113	24.85	30.18	+ .12	42.4	+2.6	73	17	54	13	26	31	38	20	49	.35	- .2	3	7.1	a.	25	nw.	6	14	10	6	4.0	4.0	0	0						
Pueblo ¹	4,690	5	36	25.41	30.20	+ .15	39.6	+1.3	73	17	57	11	29	22	52	21	57	.35	0	4	6.5	nw.	33	w.	4	11	12	7	4.5	5.2	0	0						
Concordia	1,392	50	58	28.70	30.21	+ .13	40.8	-6.6	76	17	52	22	27	30	41	26	65	.40	- 6	2	7.6	w.	31	n.	7	14	8	9	4.9	5.0	0	0						
Dodge City ¹	2,509	5	58	27.53	30.19	+ .12	42.6	- .0	76	17	56	17	29	29	44	20	36	.62	0	- 7	1	14.4	n.	48	nw.	7	14	8	8	4.2	5.2	0	0					
Wichita ¹	1,358	6	64	28.72	30.18	+ .10	44.1	-7.7	73	18	56	24	27	32	40	20	65	.07	- 1.3	3	12.9	s.	34	s.	11	16	7	7	3.9	4.0	0	0						
Oklahoma City ¹	1,214	10	47	28.88	30.18	+ .10	50.2	+1.4	78	18	62	29	39	38	35	33	59	.37	- 1.5	2	8.0	s.	22	nw.	6	19	6	5	3.2	3.3	0	0						
Tulsa ¹	674	10	61	29.45	30.18	-	48.6	-3.3	76	18	61	27	30	36	41	35	66	.02	- 2.1	1	9.7	s.	27	s.	8	17	7	6	3.7	3.8	0	0						
Southern Slope																																						
Abilene ¹	1,738	10	56	28.34	30.16	+ .09	55.0	+1.5	85	5	65	31	29	42	40	36	55	.86	- .5	3	8.5	s.	24	nw.	7	16	5	9	3.7	3.7	0	0						
Amarillo ¹	3,676	5	42	26.40	30.19	+ .14	44.4	+6.6	79	5	59	20	29	30	43	25	56	.39	- 5	3	13.7	sw.	42	n.	6	18	8	9	4.3	5.2	0	0						
Del Rio	960	63	71	29.15	30.15	+ .10	58.7	-1.3	86	6	68	35	9	50	55	46	70	1.72	+ 5	5	8.1	e.	30	nw.	7	10	6	14	5.5	5.5	0	0						
Roswell	3,566	75	85	26.51	30.17	+ .14	47.4	-7.7	84	5	64	20	8	31	52	26	49	.58	- 3	2	6.3	s.	30	n.	6	20	5	5	2.9	4.0	0	0						
Southern Plateau																																						
El Paso ¹	3,778	5	85	28.29	30.10	+ .10	51.2	+1.1	78	5	66	21	8	36	41	25	43	1.53	+1.0	3	8.2	n.	37	n.	6	20	6	4	3.0	4.2	0	0						
Albuquerque ¹	5,314	5	48	24.86	30.12	+ .04	44.3	+1.0	72	5	58	19	7	30	36	24	47	.14	- 3	3	8.2	n.	38	nw.	6	20	7	3	2.4	2.4	0	0						
Phoenix ¹	1,107	39	87	28.86	30.00	+ .02	61.8	+2.1	85	19	78	38	28	46	42	33	44	.00	- 7	0	4.7	e.	19	s.	21	25	4	1	1.8	2.0	0	0						
Tucson ¹	2,555	6	30	27.40	30.00	+ .04	61.6	- .5	85	13	77	30	28	46	41	27	31	.00	- 8	0	5.9	n.	26	nw.	26	28	2	0	2.1	2.1	0	0						
Yuma	142	9	54	30.00	30.00	+ .02	64.3	+1.9	87	4	79	24	28	50	31	34	.00	- 3	0	5.9	n.	26	s.	26	28	2	0	0.0	0.0	0	0							
Independence	3,957	5	26	26.11	30.17	+ .12	48.3	+1.1	74	10	65	25	1	32	45	28	46	.00	- 3	0	n.	-	-	-	-	-	-	-	-	-	-	-	-					
Middle Plateau																																						
Reno ¹	4,527	20	52	25.60	30.20	+ .09	40.2	+2.5	60	10	60	15	7	21	52	26	64	.29	- 4	4	3.9	w.	30	s.	20	10	12	8	5.1	5.1	1.6	0						
Topopah	6,090	9	20	24.18	30.19	+ .04	41.8	+6.6	63	10	51	24	1	33	26	26	60	.56	+ 2	4	4	se.	23	w.	30	11	10	9	4.6	4.6	0	0						
Winnemucca	4,339	5	56	25.77	30.21	+ .07	39.8	+1.4	68	15	56	11	27	24	45	25	61	.43	- 2	2	7.2	ne.	24	e.	26	20	5	4	2.7	2.7	0	0						
Modena	5,473	10	46	24.75	30.18	+ .10	38.0	+0.6	71	11	55	9	7	21	49	26	47	.17	- 1	2	7.8	w.	24	n.	5	11	10	9	5.1	5.1	0	0						
Salt Lake City ¹	4,227	32	46	25.79	30.25	+ .13	39.9	+5.5	67	19	52	20	7	28	30	30	71	.05	- 1.1	4	6.5	se.	25	nw.	5	14	10	6	3.9	3.9	0	0						
Grand Junction	4,602	60	68	25.56	30.19	+ .11	41.3	+2.0	60	4	54	17	30	28	36	23	51	.29	- 3	1	4	9.9	s.	25	w.	5	14	10	6	7.6	7.6	0	0					
Northern Plateau																																						
Baker ¹	3,471	36	54	26.63	30.27	+ .11	38.6	+2.6	58	15	48	22	6	29	33	30	78	.46	- 6	4	4.8	se.	20	w.	4	6	6	18	0.7	0.7	0	0						
Boise ¹	2,739	5	49	27.37	30.26	+ .09	40.0	+3.3	60	15	49	24	21	30	31	32	74	.50	- 8	4	7.9	se.	28	nw.	5	6	7	17	6.8	6.8	0	0						
Pocatello ¹	4,478	5	31	26.66	30.28	+ .14	37.6	+3.5	62	19	48	16	7	27	36	28	72	.42	- 6	3	6.3	sw.	34	w.	5	8	6	16	6.7	6.7	0	0						
Spokane ¹	1,929	27	42	28.18	30.26	+ .16	37.6	-9.5	57	4	45	24	1	30	26	33	85	.90	- 1.5	10	4.2	e.	23	sw.	4	8	2	8	2.0	2.0	0	0						
Walla Walla	991	57	65	29.18	30.26	+ .13	40.9	-9.1	64	4	46	26	1	36	24	26	58	.55	- 1.5	6	4.2	s.	21	w.	4	1	5	24	8.7	8.7	0	0						
Yakima	1,076	58	67	29.08	30.24	-	39.8	+9.9	62	4	46	26	1	33	24	27	77	.46	- 2.2	6	3.6	w.	20	sw.	4	2	4	24	8.7	8.7	0	0						
North Pacific Coast Region																																						
North Head	211	5	56	29.86	30.06	+ .03	51.4	+3.2	64	15	56	39	6	46	15	43	75	4.07	- 4.4	14	13.3	e.	60	se.	29	5	7	18	7.3	7.3	0	0						
Seattle ¹	125	90	321	29.99	30.12	+ .08	48.4	+2.8	60	9	54	37	25	43	20	42	85	1.63	- 3.4	12	6.7	se.	34	sw.	4	4	2	12	7.4	7.4	0	0						
Tacoma	194	172	201	29.92	30.11	+ .07	46.4	+1.8	63	9	52	32	26	41	21	22	80	4.30	- 4.0	12	5.5	n.	26	sw.	4	2	2	12	7.4	7.4	0	0						
Tatoosh Island	86	9	61	29.00	30.08	+ .11	50.1	+4.2	64	16	54	41	23	46	14	43	80	4.30	- 7.6	16	19.7	e.	47	e.	14	2	3	25	8.6	8.6	0	0						
Medford ¹	1,329	29	58	28.74	30.16	+ .04	44.3	+5.6	63	4	54	23	26	35	34	39	82	1.26	- 1.1	8	nw.	30	n.	21	11	17	7.3	7.3	0	0								
Portland, Oreg. ¹	154	68	106	29.98	30.14	+ .04	48.6	+1.8	62	9	54	36	1	43	20	40	81	2.20	- 3.9	13	5.9	e.	21	s.	30	4	0	16	7.2	7.2	0	0						
Roseburg	510	45	76	29.59	30.14	+ .02	48.6	+2.7	68	4	56	34	25	41	27	44	82	3.94	- 7	10	3.0	w.	18	w.	4	0	9	21	7.7	7.7	0	0						
Middle Pacific Coast Region																																						
Fresno ¹	327	5	35	29.74	30.10	+ .04	54.0	+1.6	68	27	60	39	21	46	25	48	81	3.59	- 1.6	7	5.5	se.	24	n.	5	7	5	18	7.1	7.1	0	0						
Los Angeles	338	223	250	29.69	30.03	+ .01	65.0	+4.1	85	10	76	44	14	54	32	35	41	0.05	- 1.2	2	6.8	ne.	25	de.	16	22	4	4	2.8	2.8	0	0						
San Diego ¹	87	20	53	29.95	30.03	+ .01	61.7	+2.4	83	16	74	45	29	50	32	45	61	.03	- 7	2	4.9	n.	17	20	6	4	2	28	0	0	0							

LATE REPORTS FOR OCTOBER 1943

1 Data are airport records.

Data are airport records. Barometric data (adjusted to old city elevation) and hygrometric data from airport; otherwise city office records.

- Barometric data (adjusted to sea level)
- Observations taken bihourly
- Pressure (adjusted to old city)

* Pressure (adjusted to old city elevation) temperature and hygrometric data from airport, otherwise city office records.
** Temperature and precipitation from city office records, other data from airport.

• Temperature and precipitation from city office records, other data from airport.
NOTE.—Except as indicated by notes 1, 2, 4 and 5 data in table are city office rec

NOTE.—Except as indicated by notes 1, 2, 4 and 5 data in table are city office records.

SEVERE LOCAL STORMS, NOVEMBER 1943

(Compiled by Mary O. Souder)

[The table herewith contains such data as has been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Port Gibson, Miss., vicinity of	Nov. 6	9 a. m.	150	0	\$2,500	Tornado-----	The Bethel Presbyterian Church, erected about 1826, destroyed. Registered cattle valued at \$2,500 killed; several cabins blown away; many trees down.
Yazoo City, Miss., vicinity of McComb, Miss.	6	A. m.		2	5,000	Wind-----	Property damaged.
Vaiden, Miss., vicinity of	6	4:30 p. m.		0		Tornado-----	A home and several shacks demolished; others damaged.
6	5 p. m.		500	2		do-----	3 dwellings with barns and outbuildings completely destroyed; 8 persons injured; several livestock killed.
Freeport, Tex.	6	5:50 p. m.	400	2	450,000	do-----	Storm moved from south-southwest to north-northeast. 36 persons injured; 260 homes and buildings damaged or destroyed; path 5 miles long.
Redwood, Miss.	6	7:45 p. m.	100	0	5,000	do-----	School building and several residences badly damaged.
Galveston, Tex., southwest portion.	6	8 p. m.	100-900	0	150,000	Tornado, excessive rain.	Several hundred persons injured, 33 seriously; property damaged; path 5 miles long. Debris gave evidence of rotary winds, although darkness and excessive rainfall prevented observance of sky conditions.
Marksville, Maurice, Abbeville, Mount Herman, and Homeplace, La., and vicinities.	6-7	9:15 p. m., 6th-7:10 a. m., 7th.	440-1,700	5	210,000	do-----	Several houses destroyed and property damaged; 15 persons injured.
Sioux City, Iowa, and vicinities.	6-7	-----				Snow-----	Rail and bus service slowed; all planes at army air base grounded.
Minnesota, southern and eastern counties.	6-8	-----		5	1,100,000	Glaze, sleet, snow, and ice.	10 inches of snow recorded at Minneapolis was the heaviest of record for so early in the season. In the vicinity of Storden drifts as high as 15 feet were reported. Highway traffic blocked for several days, some side roads remaining closed for a week or more. Hundreds of motors abandoned in deep snow drifts with transportation at standstill and trains 24 to 48 hours late. There was difficulty about 11 a. m., of the 7th from ice and snow of considerable thickness on wires that had begun to form on noon of the 6th. The heaviest ice formation was in the Maple Plain-Howard Lake and Glencoe-Gaylord areas. Total loss to overhead wire systems estimated at \$250,000. Trees and shrubbery damaged considerably in places. Turkeys valued at \$750,000 were smothered to death by the deep snow and crowding before shelter could be provided. Navigation on Lake Superior impeded. High winds produced unusually heavy seas over the lake. 65 ore-carrying ships, or approximately 43 of the ore-carrying fleet were anchored in the Duluth-Superior harbors the night of the 8th, awaiting abatement of the storm. Several loading docks damaged, few fishing docks demolished, and several spur railroad tracks on the water front washed out. Schools closed several days; many accidents resulted from poor visibility.
South Dakota, eastern section.	6-8	-----				High wind and snow-----	Rail and motor transportation slowed; highways blocked; many schools closed, especially along the extreme eastern border.
Des Moines, Iowa.	7	P. m.		1		Wind and snow-----	Light snow with temperature around freezing and high winds. Motor accident responsible for 1 death and several injuries because of obscure vision. All flights of the Mid-Continent Airlines from Des Moines to the north were canceled because of the storm. United Air Lines planes, however, continued to operate on their east and west trips.
Menominee, Mich.	7-8	-----				Wind-----	Considerable damage to property from strong winds and high waves.
Nebraska, northeastern and extreme eastern portions.	7-8	-----		2		Wind and snow-----	Snow depths ranging up to 6 inches recorded. Several roads closed for a few days; number of motorists marooned at filling stations for a day or more.
Wisconsin	7-8	P. m.				Rain, snow, and glaze-----	Rain turned to snow over southern section and heavy, wet, drifting snow over northwestern counties. Snow, glaze, and high winds broke many utility lines and poles, completely isolating Ashland and other northwestern cities. Snow from 10 to 18 inches deep in extreme northwestern counties and much deeper in drifts blocked county roads for several days with highways icy and schools closed 1 to 2 days. Damage in thousands of dollars.
Washington Grove, Md., and vicinity.	8	5:53 p. m., eastern war time.	25-50	0	6,000	Tornado-----	This storm struck more than a mile south of Washington Grove. From there it moved over a trajectory almost due north for a distance of slightly more than a mile; 3 garages and several small buildings demolished. The funnel-cloud lifted and descended at short intervals.
Clinton, Forestville, and Camp Springs, Md., and vicinities.	8	9:02 p. m., eastern war time.	25-75	0	12,000-15,000	do-----	The storm first struck near Clinton, Md., about 6 miles south-southwest of Forestville, ripping off the corner of a house and tearing down a barn and garage. It then traveled north-northeastward, cutting a path through the grounds of the Army's Camp Springs Air Base, tearing down trees and some old shacks. Emerging from the Base grounds it struck and demolished a couple of houses and then moved on about a mile farther to Forestville where it destroyed a well-constructed filling station building. From there it moved on to the north-northeast for some 2 miles doing more damage.

SOLAR RADIATION AND SUNSPOT DATA FOR NOVEMBER 1943

[Solar Radiation Investigations Section, I. F. HAND in charge]

SOLAR RADIATION OBSERVATIONS

Explanations of the tables and references to descriptions of instruments, stations, and methods of observation, and to summaries of data, are given in the January 1942 REVIEW, page 20; a list of pyrheliometric stations is also given in the REVIEW for January 1943, page 12.

TABLE 1.—*Solar radiation intensities during November 1943*

[Gram-calories per minute per square centimeter of normal surface]

Madison, Wis.

Date	Sun's zenith distance										Local mean solar time
	7:30 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	
	75th mer. time	Air mass									
e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.	
Nov. 1	mb.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mb.	
Nov. 1	7.2	0.79	0.86	1.02	1.21	1.44	1.21	1.21	1.21	6.6	
Nov. 13	3.0										
Nov. 16	1.6	.99	1.13	1.25		1.54		1.21		2.7	
Nov. 19	5.1	.88	1.02	1.14		1.43				2.1	
Means		.89	1.00	1.14	(1.21)	1.47	(1.21)	(1.22)			
Departures		+.02	+.01	-.01	-.10	-.05	-.12	+.25			

Blue Hill, Mass.											
	6.1	0.97	1.07	1.18	1.22	1.26	1.26	0.99	0.89	6.4	
Nov. 4	5.8	.86	.95	1.04						6.6	
Nov. 7	6.1	.66		.89				0.90	.78	.67	8.7
Nov. 10	4.6							.99	.86	.77	4.2
Nov. 12	4.0	.86	.96	1.11	1.30		1.28	1.16	1.06	.92	3.3
Nov. 14	3.5	.97	1.07	1.17				1.15	1.03	.94	3.2
Nov. 15	3.3	.83	.89	.97				1.23		.78	3.5
Nov. 17	4.2	.78									2.2
Nov. 18	3.3	.96	1.03	1.14				.96	.82	.71	4.0
Nov. 24	5.6				1.20						5.1
Nov. 25	4.4	.99	1.09	1.19	1.37			1.18	1.06	.97	4.8
Nov. 26	4.2	1.00	1.09					1.10	1.00		4.0

TABLE 1.—*Solar radiation intensities during November 1943—Con.*

[Gram-calories per minute per square centimeter of normal surface]

Blue Hill, Mass.—Continued

Date	Sun's zenith distance										Local mean solar time
	7:30 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	
	75th mer. time	Air mass									
e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.	
Nov. 28	mb.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mb.	
Nov. 29	2.7	1.01									2.6
Means		.90	1.02	1.10	1.30		(1.27)	1.10	.96	.85	
Departures		-.01	+.01	-.03	+.03		+.02	.00	+.01		

Albuquerque, N. Mex.											
	4.0	1.05	1.30	1.20							
Nov. 1	4.0	1.05	1.30	1.20							
Nov. 2	2.8	1.08	1.18	1.30	1.42						
Nov. 3	3.3	1.05	1.15	1.27	1.42						
Nov. 5	4.4	1.01	1.11	1.18							
Nov. 7	2.5	1.09									
Nov. 8	1.8										
Nov. 9	2.3		1.07								
Nov. 10	3.2		1.00	1.16	1.33						
Nov. 11	2.4			1.18	1.35						
Nov. 12	3.0										
Nov. 13	3.2				1.08	1.24					
Nov. 16	2.9										
Nov. 18	4.0										
Nov. 19	4.4										
Nov. 20	3.7	.89	.90	1.10	1.27						
Nov. 27	4.0	.94	1.17	1.32							
Nov. 28	3.8	1.11	1.21	1.33							
Nov. 29	4.0	.96	1.08								
Nov. 30	3.7			1.21							
Means		.91	1.12	1.21	1.34						
Departures		-.12	-.02	-.04	-.04						

* Light smoke.

* Extrapolated.

TABLE 2.—*Daily totals and weekly means of solar radiation (direct+diffuse) received on a horizontal surface*
 [Gram-calories per square centimeter]

1943	Washington, D. C.	Madison, Wis.	Lin- coln, Nebr.	East Lansing, Mich.	New York, N. Y.	Fair- banks, Alaska	Nash- ville, Tenn.	Twin Falls, Idaho	La Jolla, Calif.	New Or- leans, La.	River- side, Calif.	Blue Hill, Mass.	Ithaca, N. Y.	New- port, R. I.	State Col- lege, Pa.	Put-in- Bay, Ohio	East Ware- ham, Mass.	Davis, Calif.	Fresno, Calif.	
	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	
Oct. 29	331	306	270	271	160	332	278	283	416	177	220	176	283	200	299	236	354	370		
Oct. 30	242	284	127	276	22	227	150	380	433	319	34	151	23	132	314	27	367	372		
Oct. 31	187	135	336	21	336	167	165	380	357	350	232	205	204	322	41	237	386	349		
Nov. 1	287	292	—	81	230	257	326	378	304	371	322	234	322	261	228	312	346	354		
Nov. 2	69	74	—	46	121	12	275	388	307	368	111	20	174	38	185	142	349	339		
Nov. 3	241	60	—	67	207	291	244	379	364	367	166	76	192	69	101	158	245	335		
Nov. 4	338	114	—	184	260	339	46	371	428	361	205	124	270	165	203	278	214	332		
Mean	242	181	—	164	191	56	232	212	366	370	330	184	141	209	185	196	199	337	350	
Departure	-4	-4	—	-21	+11	+40	-1	+19	+58	+17	-32	-15	-15	+25	+32	+16	+17	+18		
Nov. 5	228	57	—	26	165	—	171	276	361	430	296	199	126	212	131	126	220	367	311	
Nov. 6	300	38	73	74	229	—	223	298	348	171	344	200	210	191	270	86	180	356	308	
Nov. 7	275	41	166	23	256	—	74	290	352	30	301	250	229	273	244	62	284	204	297	
Nov. 8	45	45	198	46	33	—	254	270	297	500	332	48	91	69	40	121	108	201	180	
Nov. 9	134	102	249	78	86	—	40	254	323	409	336	16	140	26	98	105	31	317	305	
Nov. 10	267	123	120	54	250	—	320	227	350	466	351	247	108	255	101	68	230	290	320	
Nov. 11	147	185	189	124	100	—	329	230	334	463	332	40	106	112	105	195	76	252	206	
Mean	199	84	142	61	169	44	202	264	338	366	327	144	144	162	141	109	161	297	284	
Departure	-23	-78	-87	-25	+6	+8	+52	+22	+57	+25	-47	-9	-48	-9	-37	-33	+18	-14		
Nov. 12	279	107	339	71	260	—	228	207	331	428	301	281	119	290	100	56	296	300	297	
Nov. 13	233	283	202	118	91	—	291	237	274	412	291	179	64	189	163	118	204	308	295	
Nov. 14	299	149	260	135	286	—	298	242	236	269	305	254	98	298	183	224	299	278	296	
Nov. 15	160	77	170	50	60	—	168	253	249	329	319	159	24	120	56	32	170	254	263	
Nov. 16	172	264	148	128	71	—	69	224	142	306	122	11	108	57	92	158	61	99	127	
Nov. 17	208	205	261	94	224	—	304	176	186	466	68	268	54	253	203	78	261	115	152	
Nov. 18	234	164	261	141	144	—	288	172	309	—	296	246	127	225	228	210	254	174	284	
Mean	226	178	234	105	162	23	235	216	247	388	243	200	90	205	146	126	220	218	245	
Departure	+24	+24	+22	+12	-4	+18	+47	-45	+129	-34	+37	-21	+12	-8	-15	+34	-13	-6		
Nov. 19	255	233	275	205	165	—	283	110	222	410	74	184	100	206	188	255	233	118	188	
Nov. 20	171	190	250	209	78	—	251	220	314	369	222	123	114	128	107	231	139	68	188	
Nov. 21	176	177	295	63	169	—	273	90	292	407	230	199	57	204	125	100	202	293	254	
Nov. 22	256	218	251	67	175	—	281	199	274	475	319	46	40	85	146	44	81	261	269	
Nov. 23	274	129	262	197	136	—	289	46	315	476	290	30	102	39	216	226	37	243	284	
Nov. 24	262	137	167	181	246	—	285	108	292	442	290	225	199	206	219	170	198	212	254	
Nov. 25	262	132	46	165	247	—	269	96	330	—	296	242	222	243	218	226	—	245	290	
Mean	236	175	221	153	174	10	276	134	291	435	248	150	129	158	170	182	148	206	239	
Departure	+51	+44	+23	+33	-7	+66	-36	-8	+166	-25	-1	+5	-1	+30	+51	-10	-8	+2		
Nov. 26	215	36	208	22	168	—	184	53	316	—	310	233	172	232	154	132	—	271	241	
Nov. 27	115	226	69	94	115	—	156	140	287	—	280	97	39	105	64	132	75	239	186	
Nov. 28	230	74	154	97	252	—	252	46	317	—	301	238	50	242	98	104	244	259	224	
Nov. 29	206	128	262	162	222	—	193	207	302	—	296	217	135	227	142	102	245	210	262	
Nov. 30	140	196	237	136	120	—	178	101	278	—	274	96	74	184	80	129	62	155	228	
Dec. 1	215	100	236	140	113	—	189	132	227	250	264	184	154	201	136	164	222	241	146	
Dec. 2	178	133	197	112	79	—	21	138	287	181	294	126	46	124	137	174	118	233	243	
Mean	186	126	195	109	153	9	168	117	288	—	288	170	96	188	116	134	163	233	218	
Departure	+20	60	+14	+24	-4	+18	-32	+12	+35	+13	+4	+20	-7	+15	+18	+37	+4			

ACCUMULATED DEPARTURES ON DECEMBER 2, 1943

+3465	+3276	+5901	—	-4641	+1260	+6111	+1190	-4921	—	+1491	-5523	—	-1855	-4459	+98	-266	+168	—
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POSITIONS, AREAS, AND COUNTS OF SUNSPOTS FOR NOVEMBER 1943

POSITIONS, AREAS, AND COUNTS OF SUNSPOTS FOR NOVEMBER 1943—Continued

[Communicated by Capt. J. F. Hellweg, U. S. N. (Ret.) Superintendent, U. S. Naval Observatory.] All measurements and spot counts were made at the Naval Observatory from plates taken at the observatories indicated. Difference in longitude is measure from the central meridian, positive toward the west. Latitude is positive toward the north. Areas are corrected for foreshortening and expressed in millions of Sun's hemisphere. For each day, under longitude, latitude, area of spot or group, and spot count are included assumed longitude of center of the disk, assumed latitude of center of the disk, total area of spots and groups and total spot count.

Date	Eastern standard time	Mount Wilson group No.	Heliographic						Plate quality	Observatory	Heliographic						Area of spot or group	Spot count	Plate quality	Observatory	
			Difference in longitude	Longitude	Latitude	Distance from center of disk	Area of spot or group	Spot count			Difference in longitude	Longitude	Latitude	Distance from center of disk							
Nov. 1	11 11 3	7621	+28	79	+15	31	242	1	G	U. S. Naval.	1943	10 44	7626	-83	78	+13	83	242	1	G	Do.
				(51)	(+4)		242	1					7625	-80	81	+18	80	194	9		
2	10 32	7621	+42	80	+15	43	230	1	G	Mt. Wilson.			7625	-70	77	+20	71	12	1	G	Do.
				(38)	(+4)		230	1					7626	-69	78	+14	70	206			
3	10 31	(*) 7621	+30 +55	55 80	+19 +14	33 56	16	5	G	U. S. Naval.			7625	-69	78	+18	70	73	3		
				(25)	(+4)		246	6					7625	-67	80	+16	68	73	9		
4	11 9	(*) 7621	-36 +68	336 80	-3 +14	37	6	3	F	Do.			7626	-43	78	+14	45	194	1	G	Do.
				(12)	(+4)		218	1					7625	-42	79	+19	44	12	3		
5	10 34	7621	+81	80	+14	81	218	1	P	Do.			7625	-40	81	+17	42	145	10		
				(350)	(+4)		218	1					7626	-30	78	+14	32	194	1	F	Do.
6	10 18		No spots						F	Mt. Wilson.			7625	-27	81	+17	30	121	9		
7	10 35		No spots						G	Do.			7626	-17	78	+14	21	170	1	F	Do.
8	11 37		No spots						G	Do.			7625	-16	79	+16	21	36	1		
9	10 32		No spots						G	Do.			7625	-11	84	+16	18	73	10		
10	10 38		No spots						F	U. S. Naval.			7626	(95)	(+2)			279	12		
11	10 47		No spots						G	Do.			7625	-3	78	+13	12	170	1	F	Do.
12	10 16		No spots						G	Mt. Wilson.			7626	-3	78	+15	14	48	5		
13	11 36	7622	-30	223	-9	32	97	14	G	U. S. Naval.			7625	+3	84	+15	14	121	8		
				(253)	(+3)		97	14					7626	(81)	(+2)			339	14		
14	11 0	7622	-19	221	-8	22	24	3	F	Do.			7625	-17	78	+14	21	170	1	F	Do.
		7622	-13	227	-10	18	48	1					7626	-16	79	+16	21	36	1		
		(*)	+45	285	+4	45	6	2					7625	-11	84	+16	18	73	10		
				(240)	(+3)		78	6					7626	(95)	(+2)			279	12		
15	10 55	7622	0	227	-10	13	48	1	F	Do.			7625	-3	78	+13	12	170	1	F	Do.
		7623	+59	286	+4	59	24	3					7626	+11	79	+13	17	145	1		
				(227)	(+3)		72	4					7625	+12	80	+15	18	24	2		
16	11 9	7622	+13	226	-9	17	36	5	F	Do.			7625	+17	85	+14	21	97	5		
		(*)	+33	245	-9	34	48	8					7626	(68)	(+1)			302	10		
		7623	+71	284	+4	71	24	6					7625	-68	348	+7	68	24	2	G	Mt. Wilson
				(213)	(+3)		108	19					7626	-65	351	+6	65	48	2		
17	11 41	(*)	+45	245	-8	47	16	4	F	Do.			7625	-43	13	-5	43	6	1		
				(200)	(+3)		16	4					7626	+23	79	+13	27	145	1		
18	11 8	7624	+50	237	+10	51	12	4	G	Do.			7625	+27	83	+16	30	24	2		
				(187)	(+2)		12	4					7625	+31	87	+14	33	48	1		
19	11 2		No spots						G	Do.			7626	(56)	(+1)			295	9		

Mean daily area for 30 days = 173

(*) Not numbered.
VG=very good; G=good; F=fair; P=poor.

Chart I. Departure ($^{\circ}\text{F.}$) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, November 1943

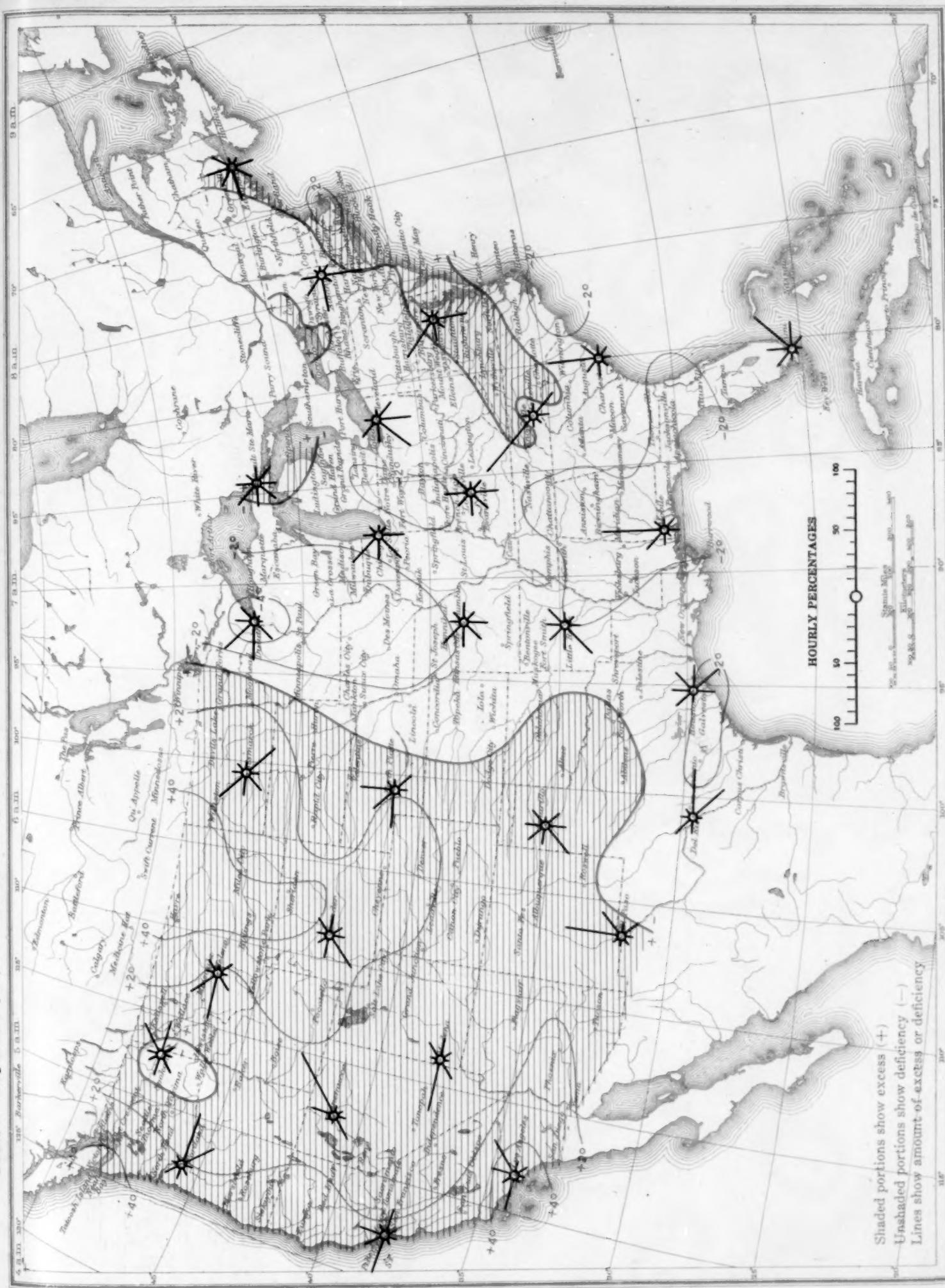
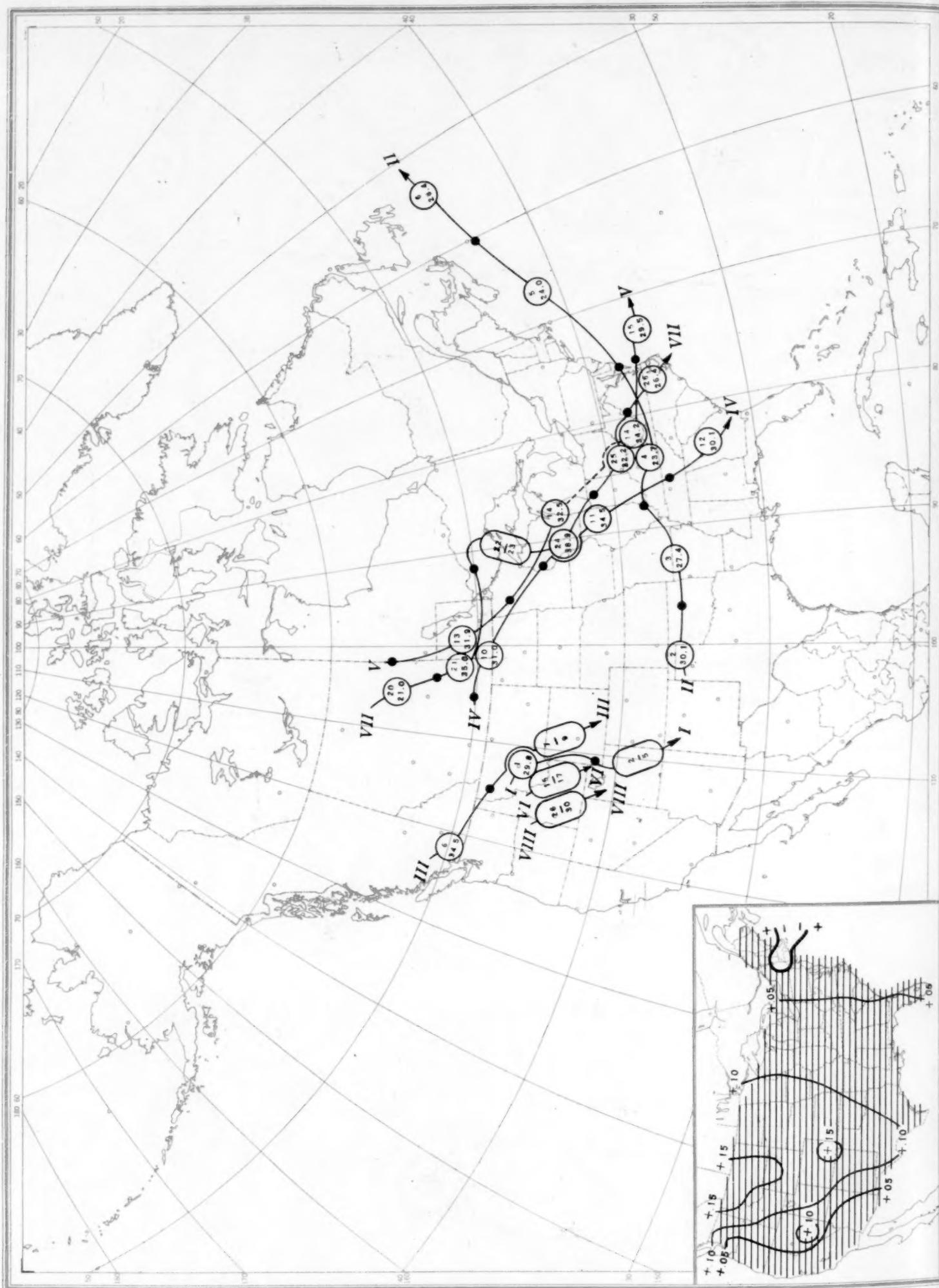


Chart II. Tracks of Centers of Anticyclones, November 1943. (Inset) Departure of Monthly Mean Pressure from Normal



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time)

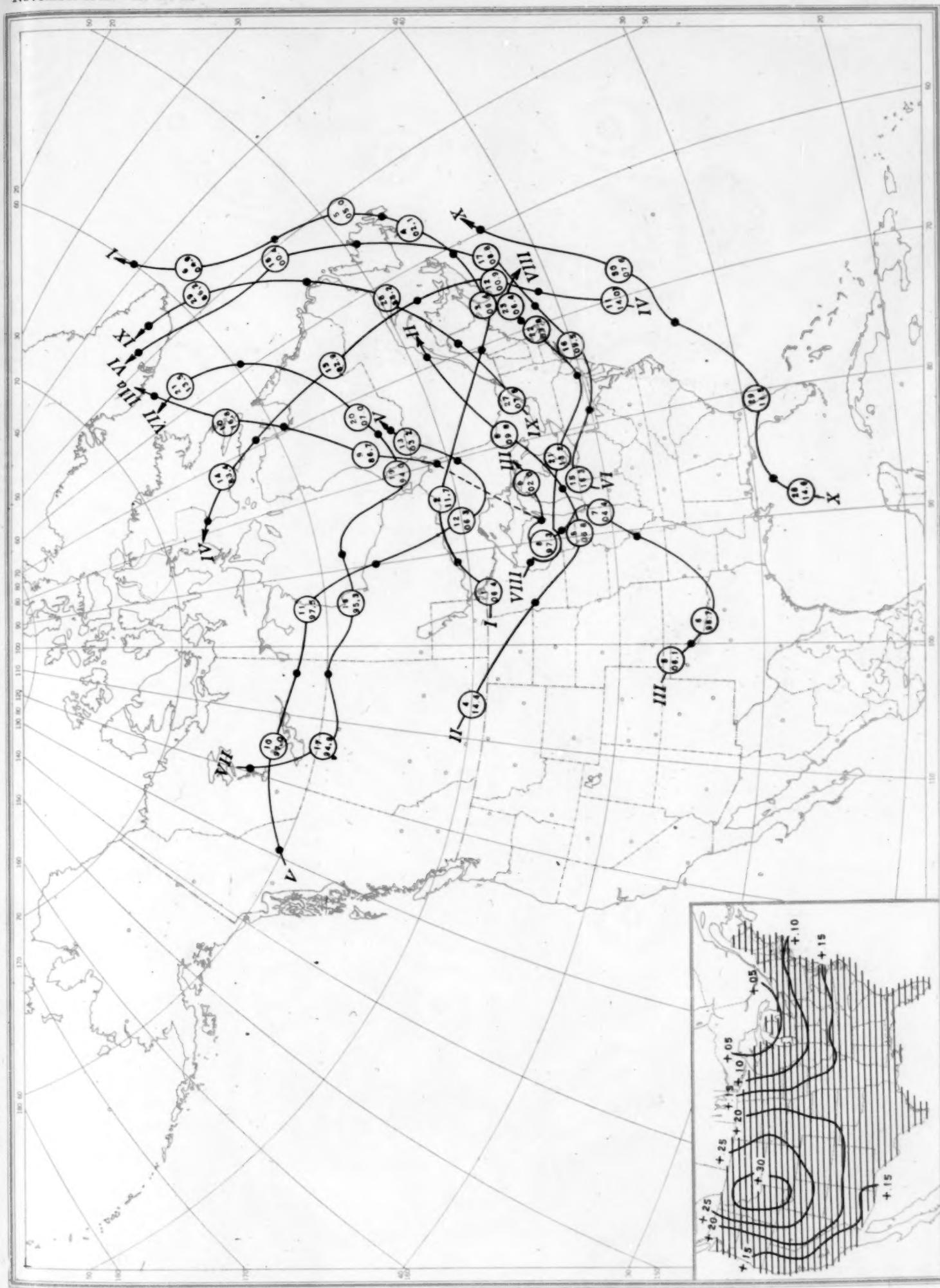
Chart III. Tracks of Centers of Cyclones, November 1943. (Inset) Change in Mean Pressure from Preceding Month

Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 7:30 p. m. (75th meridian time)

November 1943. M. W. R.

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Chart III. Tracks of Centers of Cyclones, November 1943. (Inset) Change in Mean Pressure from Preceding Month



November 1943. M. W. R.

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, November 1943

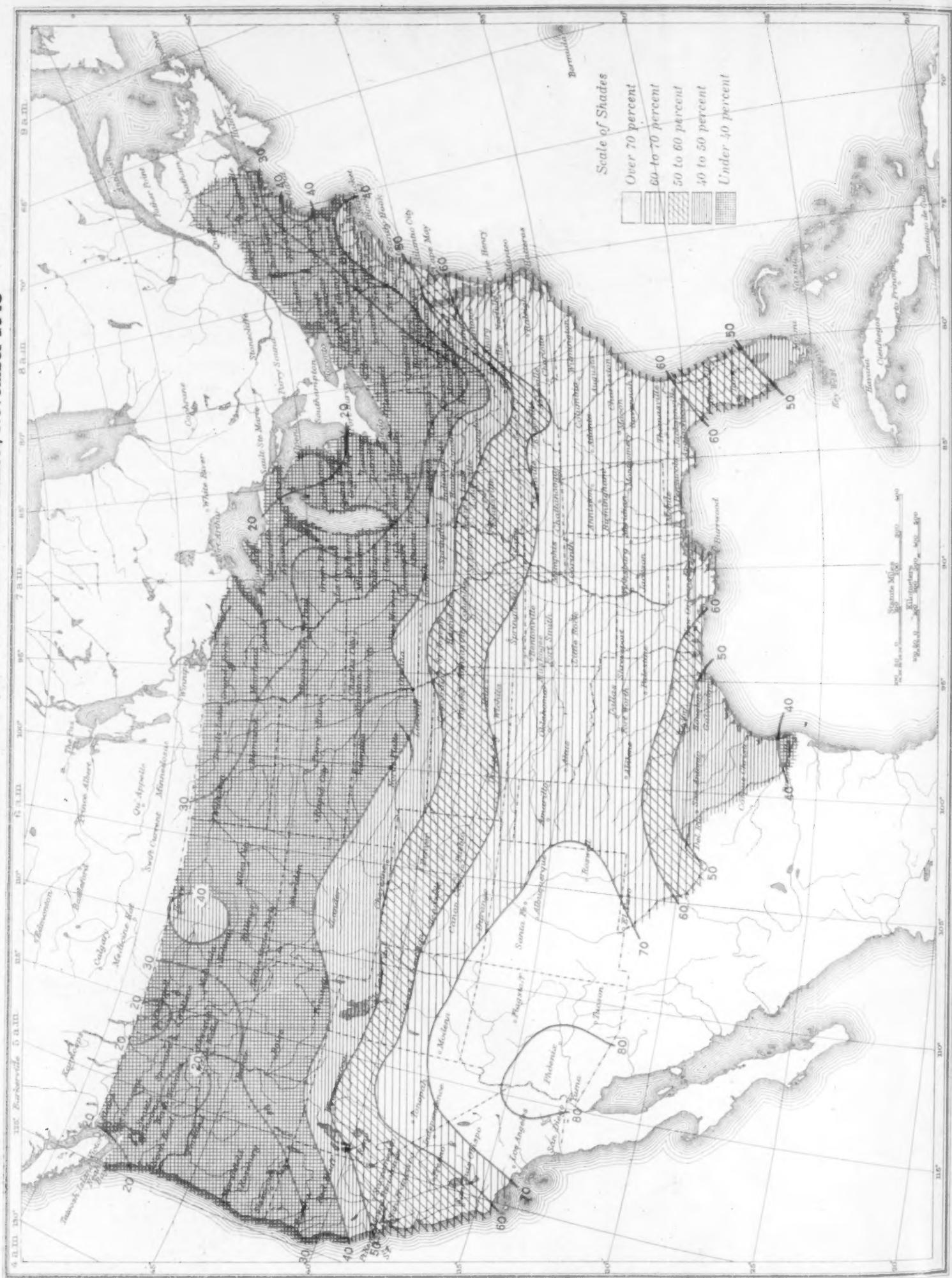


Chart V. Total Precipitation, Inches, November 1943. (Inset) Departure of Precipitation from Normal

Chart V. Total Precipitation, Inches, November 1943. (Inset) Departure of Precipitation from Normal

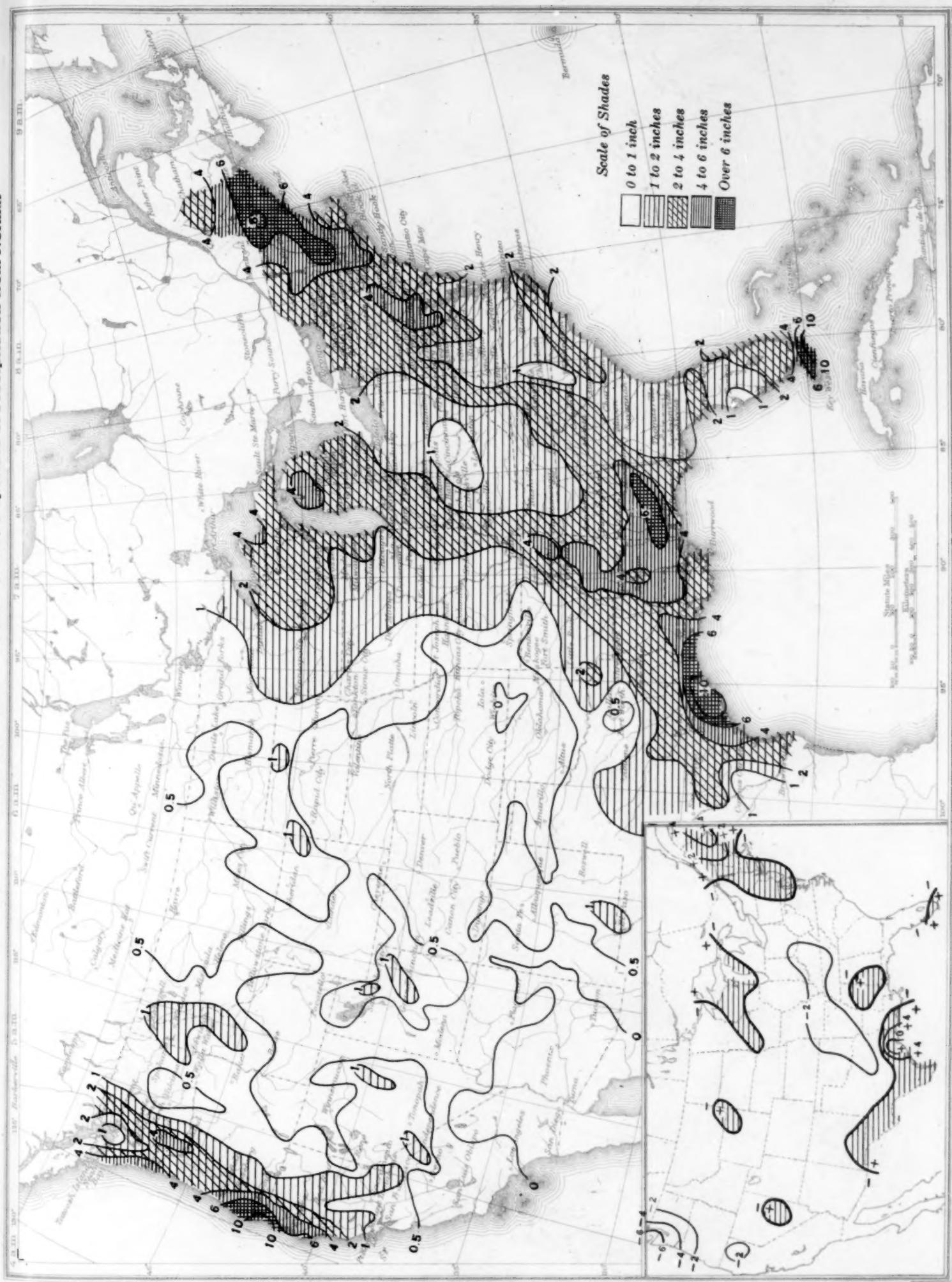


Chart VI. Isobars at Sea Level and Isotherms at Surface; Prevailing Winds, November 1943

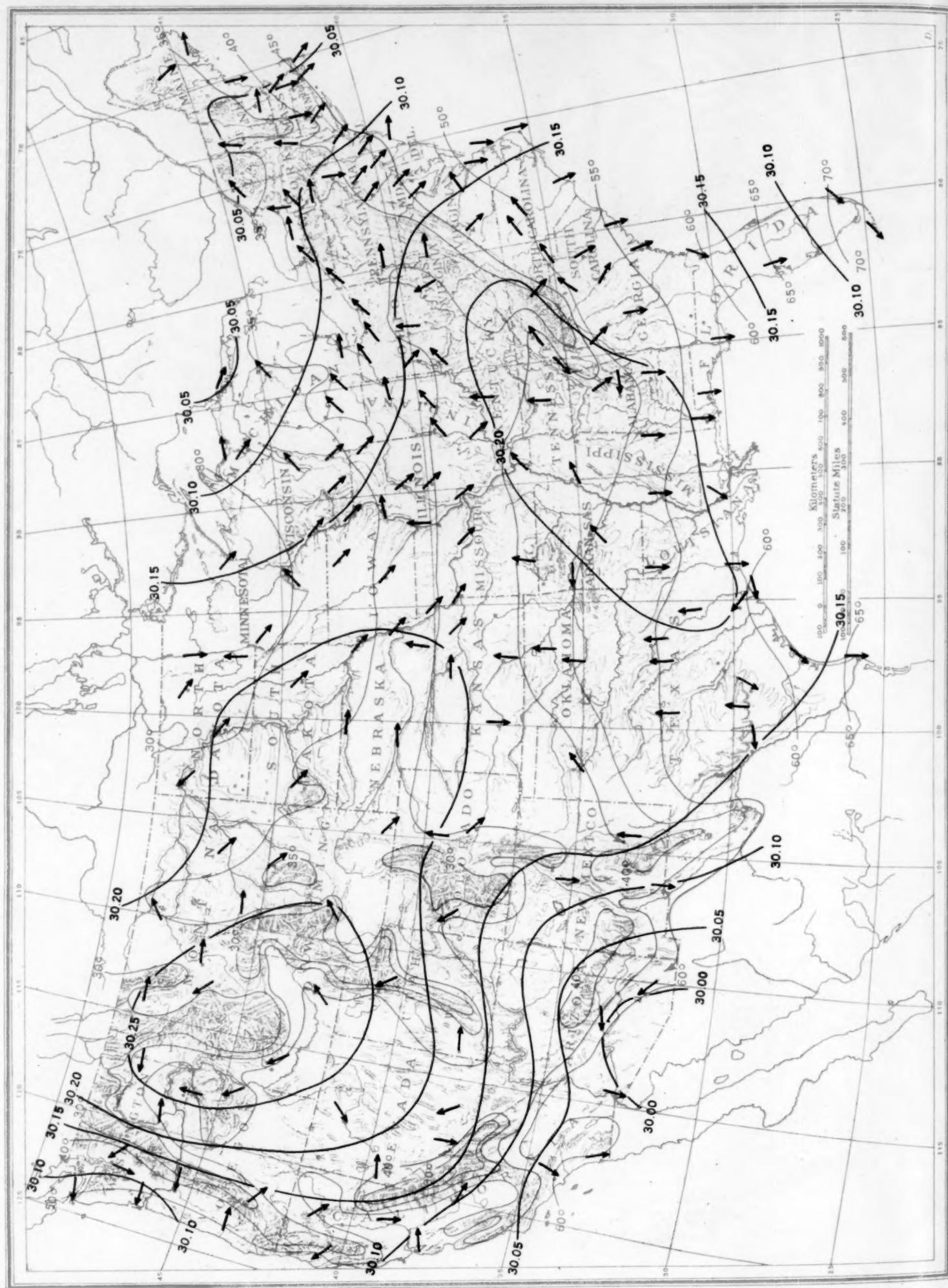


Chart VII. Total Snowfall, Inches, November 1943.

Chart VII. Total Snowfall, Inches, November 1943.



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